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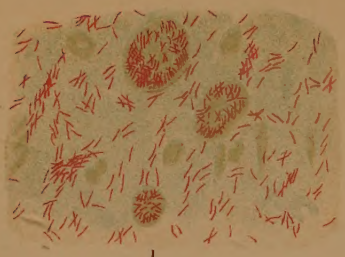
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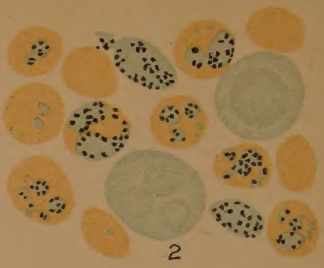
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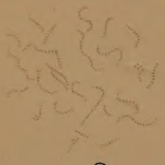
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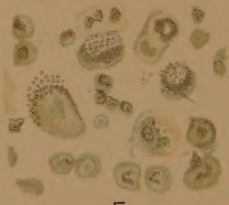
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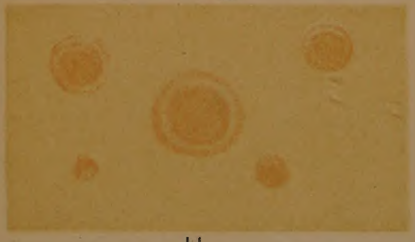
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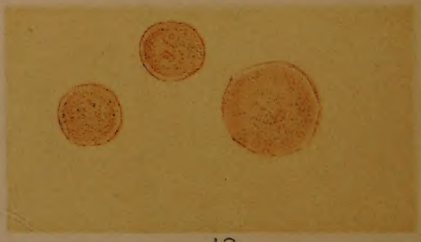
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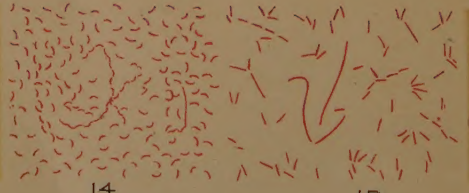
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Pathogenic Micro-organisms.

See description on page vi.

THE BOSTON
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JOURNAL.

THEORY AND PRACTICE

OF

MEDICINE

PRESENTATION COPY

PREPARED FOR

STUDENTS AND PRACTITIONERS

BY

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WITH A CHROMO-LITHOGRAPHIC PLATE AND THREE HUNDRED ENGRAVINGS

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THIS BOOK IS DEDICATED

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TO

ROBERT KOCH,

MEDICAL PRIVY COUNCILLOR OF PRUSSIA:
FOUNDER OF BACTERIOLOGY: WHOSE WORK IS MAKING A SCIENCE
OF THE ART OF MEDICINE;

BY

HIS FIRST AMERICAN STUDENT;

AND TO

GEORGE M. STERNBERG,

SURGEON-GENERAL OF THE UNITED STATES ARMY:
THE PIONEER IN THE STUDY OF PARASITISM IN THIS COUNTRY;

BY

HIS FRIEND,

THE AUTHOR.

"As for the truth, it endureth and is always strong; it liveth and conquereth forevermore."

—Esdras I. iv. 38.

"Pilate saith unto him, What is truth?"

—John xviii. 38.

"Appiè del vero il dubbio."

—Dante, *Del Paradiso*, iv. 131.

PREFACE.

In the preparation of this book the most work has been put upon the infections, as the most frequent and dangerous, at the same time the most preventable, of all diseases; and in the study of the infections the most space has been devoted to cause and diagnosis, for the reason that a knowledge of the cause establishes prevention, and with the diagnosis develops treatment, except in so far as treatment must still remain wholly symptomatic. Morbid anatomy meets here with but little consideration, and post-mortem revelations are mentioned only when they may throw a clear light upon the nature and treatment of disease. The practitioner who looks up from the signs and lesions to the cause will entertain more hope of treatment; for the practice of medicine is now not so empirical as the symptomatologists claim, or so barren as the pathologists deplore.

From this standpoint this book is prepared for the student and practitioner of medicine, but especially for the young physician who, with microscope and test tube, would fit himself for the higher places in his profession.

With the most highly appreciated generosity, the Messrs. Wm. Wood & Co., Lea Bros. & Co., and W. B. Saunders have permitted the author to select, condense, or make use of contributions prepared by him for works recently or just issued by them. These chapters (selections from which constitute perhaps one-twelfth of the present volume), in Wood's "Reference Handbook," Pepper's "System of Medicine," Hare's "Therapeutics," Pepper's "American Text Book," contain accounts more full than may be found in an ordinary text book, whose chief merit must consist in the succinct presentation of the latest facts. The fact that the proof was corrected at a watering place distant from a library will excuse the absence of proper credit from any figures or statements where it may have been lost in press.

A text book must necessarily be full of shortcomings. No one so fully appreciates the vast wealth of knowledge in internal pathology, accumulated through the ages, as he who attempts to encompass it in a book, or so keenly realizes his own poverty as he who attempts to add to the general sum the most inconsiderable mite.

J. T. W.

Cincinnati, Ohio, September 1st, 1893.

PATHOGENIC MICRO-ORGANISMS.

Chiefly from Original Drawings by Koch and Löffler.

EXPLANATION OF PLATE.

FIG. 1. *Lepra.*—Fluid expressed from a nodule, stained with carbol-fuchsin, displaying bacilli, free and enclosed in large, non-nucleated cells.

FIG. 2. *Malaria.*—Plasmodium Malariæ. Protozoa from drop of blood from finger pulp after a chill, stained with methylene blue, displaying large, nucleated white blood corpuscles, smaller non-nucleated red blood corpuscles, free and filled with protozoa; also free protozoa.

FIGS. 3, 4. *Pyæmia.*—Streptococcus pyogenes and Staphylococcus pyogenes aureus.

FIG. 5. *Gonorrhœa.*—Gonococcus, cover-glass preparation, stained with methylene blue; pus cells filled with gonococci.

FIG. 6. *Pneumonia.*—Diplococcus of pneumonia (Fränkel-Weichselbaum), stained by Gram's method; section of alveolus, displaying exudation of cells with diplococci, alone and in chains, in and between the cells.

FIG. 7. *Charbon.*—Milzbrand bacilli, gelatin stick culture; upper stratum fluidified, bacilli as whitish mass at bottom of fluid; displaying two large colonies with numerous radiating outshoots into the substance of the still solid gelatin.

FIG. 8. *Cholera.*—Stick culture of cholera spirillum in gelatin, four days old; upper stratum exposed to air, fluidified to characteristic funnel shape; spirilla in mass at bottom and in neck of funnel.

FIG. 9. *Typhoid Fever.*—Gelatin stick culture of typhoid bacillus, displaying opalescent, translucent surface.

FIG. 10. *Tuberculosis.*—Pure culture of tubercle bacillus on surface of gelatin in inclined test tube, displaying dry, white scales, natural size.

FIG. 11. *Cholera.*—Gelatin surface culture of cholera spirillum, × 80, displaying irregular border and irregular "broken-glass" surface. The larger colonies, with more sunken border, lie nearer the surface of the gelatin.

FIG. 12. *Typhoid Fever.*—Gelatin surface culture of typhoid bacillus, × 80, displaying dark-brown, sharply-defined border with finely granulated surface; sometimes showing concentric zones.

FIG. 13. *Glanders.*—Bacillus mallei from spleen of field mouse, cover-glass preparation, stained with methylene blue, displaying uncolored regions resembling spores.

FIG. 14. *Cholera.*—Pure culture of cholera spirillum in bouillon, stained with fuchsin, displaying "comma" bacilli, alone and united in spirals.

FIG. 15. *Typhoid Fever.*—Pure culture of typhoid bacillus in gelatin, displaying short, thick rods as in tissues, and elongated structures in culture.

FIG. 16. *Tuberculosis.*—Tubercle bacillus from sputum, double-stained with aniline-gentian-violet and Bismarck brown.

FIG. 17. *Dysentery.*—Amœbæ coli.

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PART I.

GENERAL DISEASES.

". . . For it is also thus in nature, the greatest balsams do lie enveloped in the body of most powerful corrosives; I say moreover, and I ground upon experience, that poisons contain within themselves their own antidote and that which preserves them from the venom of themselves, without which they were not deleterious to others only, but to themselves also."

—Sir Thomas Browne, M.D., *Religio Medici.*

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INFECTIONS—PARASITES.

CHAPTER I.

Most of the diseases of plants are produced by parasites. This fact, like the discovery of the cell structure in histology, has finally been brought to bear upon the diseases of man (pathology) and other animals, with the discovery in most cases of the same cause. Thus, it has been ascertained that diseases come, for the most part, from without, and not from within.

The parasites of man are both animal and vegetable. Larger parasites lodge upon the surface—Ectozoa; or through the food or drink reach the interior of the body—Entozoa. The ectozoa produce many of the diseases of the skin; entozoa are worms in the intestinal canal.

Most of the vegetable parasites are so minute as to be microscopic. They are known as microbes or micro-organisms. They reach the recesses of the body by way of the mucous membranes or by inoculation of the skin. They multiply in the interior of the body to produce symptoms, both by their presence and their products (toxines), and cause the group of diseases distinguished as the infections.

Pathogenic micro-organisms are known, 1, by their morphology—that is, their size, shape, and general appearance; 2, by their chemical affinities, as shown in their reactions to coloring matter; 3, by their preference of soil in cultivation experiments, and the manner in which they grow in the soil; 4, by the effect produced by their introduction into the bodies of various animals.

The mass of micro-organisms belongs to the vegetable kingdom, to the subdivision cryptogamia, which forms neither flowers nor seed, but reproduces itself by spores. Pathogenic micro-organisms may be divided into:

1. Fungi, or moulds.
2. Ferments, or yeast plants.
3. Bacteria, or schizomycetes.
4. Protozoa.

The fungi include the various vegetable growths, often of such magnitude as to be visible to the naked eye, which cause many

skin diseases, and sometimes, by metastasis, as in the case of the actinomyces, affection of the internal organs. Yeast plants produce the various, chiefly the alcoholic, fermentations. Bacteria cause most infectious diseases. Protozoa certainly produce malaria and probably cause cancer.

ECTOZOA.

ANIMAL.

SCABIES (scurf ; itch).—An eczema produced partly by the itch insect (Acarus scabiei) itself, but chiefly by scratching in relief of the itch the insect causes.

The disease has been always known, is alluded to in the Bible, and was formerly regarded as a constitutional (blood) malady, the cure of which might entail worse evils.

The Acarus scabiei has a hard, crab-like body with thorny exterior; stiff hairs protrude from its borders. The head has strong jaws, which work like scissors and are fixed with teeth. Respiration is wholly cutaneous. The animal is bisexual. The female is oval-shaped, broader than long, 0.35×0.23 mm., white or gray ; the male smaller, 0.25×0.15 mm., brown or yellow. Each has two pairs of extremities in front and behind, the first pair provided with suckers, a hinder pair in the male with fasteners.

FIG. 1.—Female Acarus scabiei, dorsal surface.

The male lives in slight excavations which he makes in the surface of the skin; the female bores for herself lightly curved burrows or canals, three centimetres long, in the course of which, as she advances, she deposits eggs, one or two per day. The young acari shed the skin three or four times at intervals of six days ; first in fourteen to seventeen days, to appear after the first moult with eight legs—having had but six hitherto—and after the third with mature sexual organs.

The insect seeks naturally regions where the epidermis is thin and the deeper layers succulent, as the front of the wrist, sides of the fingers, space between the fingers, front of the axilla, flexure of the elbow, penis, nipple, etc. The face is spared except in bad cases, and in sucklings who may be infected by nurses. So, too, the disease may be carried, by scratching, to unwonted seats, even to the hairy scalp.

Scratching develops *eczema*, which is sometimes obstinate and extensive, and may require treatment after destruction of the cause of the disease.

The lesion is that form of superficial irritation which shows itself in *itching*, and which may vary in every degree of intensity from annoyance to torture, according to the extent of the disease and sensitiveness of the individual. It is usually *worse at night* and may exhaust the strength through insomnia.

The *diagnosis* rests upon, 1, the itch—the situation of the lesion; 2, the character and course of the canals—curved lines colored with fæces and studded with salient points ineffaceable on washing; 3, the demonstration of the insect itself—a white granule at the end of a canal, which, with a little practice, may be lifted out under a lens on the point of a knife or a pin.

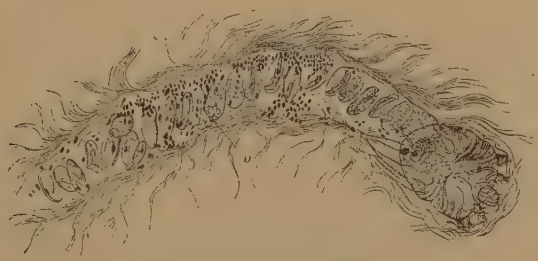


FIG. 2.—Acarus burrow, with ova.

Treatment calls for the destruction of the parasite and all its progeny—usually an easy task—and in aggravated cases applications in relief of the eczema.

There is much choice of remedy; as a rule, mild means are the best. One of the following ointments should be thoroughly rubbed into the skin:

1 ℞ Balsami Peruviani,
Styracis liquidæ. ..... āā ʒ i.
M.

2 ℞ Florum sulphuris,
Olei rusci. ..... āā ʒ ij.
Cretæ preparatæ. ..... gr. xv.
Saponis viridis,
Axungiæ. ..... āā ʒ ii.
M.

3 ℞ β naphthol. ..... ʒ ss.
Saponis viridis. ..... ℥ iss.
Cretæ preparatæ ..... ʒ ij.
Axungiæ ..... ℥ iij.
M.

4. A more elegant but more expensive preparation :

℞ Lactis sulphuris..... .... ℥ ij.
Potassii carbonatis..... .... ʒ vi.
Olei lavandulæ,
Olei caryophylli.... .....āā gtt. x.
Axungiæ..... q. s.
Ft. unguentum.

Recipes No. 2 and 3 are better than No. 1. No. 3 is the best, because it irritates less and soils least. In all cases a good quantity must be thoroughly rubbed into the affected parts. Woollen clothing should be worn, that the surface be not robbed by absorption. If there is still itching the inunction must be repeated on the following day. Bath after several days. The cure of the scabies is now complete. Any eczema left will disappear under diachylon ointment.

Bathing, as it aggravates eczema, should be avoided for four or five days, or until the skin under the ointments dries and desquamates. Finally, after bathing, the skin may be anointed with vaseline or cocoa butter.

Fig. 3. — Pediculus capitis, male.

Pediculus Capitis (head louse).—An elongated, hard body, 2 × 1 mm., which cracks between the finger nails, with six feet provided with claws for climbing and clutching hairs. The female, which greatly outnumbers the male, glues her eggs to hairs by a layer of chitin, commencing at the head end of the hair and depositing eggs upward, as many as fifty in successive layers, so that the duration of infection may be determined, on inspection with a lens, by the situation of the eggs or young (nits). The young escape in three to eight days, and become mature in eighteen to twenty days. A single female may give birth within six weeks to five thousand young.

Fig. 4.—Hair with agglutinated eggs and nits.

The irritation caused by pediculi causes *eczema* through scratching; and as such regions are avoided in combing the head, they offer quiet retreat for multiplication of the parasite and aggravation of the eczema. Continued neglect may thus lead to suppuration and agglutination of the hair into a foul, offensive mass or cap, the *plica polonica*.

The insect is strictly confined to the hair of the head, but the resultant eczema may extend to the neck or face, or in bad cases lead to lymphangitis and swelling of the neighboring glands.

Cases of light infection are best treated by frequent use of the fine-tooth comb and thorough ablution with soap. More extensive infection calls for a parasiticide, as a mixture

of equal parts of petroleum and balsam of Peru, which may be most thoroughly applied after cutting the hair short. The worst cases require more thorough saturation, as by the application and wearing, after inunction, of a flannel cap soaked in the same mixture made thinner by the addition of one-fourth part olive or cod-liver oil. Any fixed or volatile oil kills all kinds of lice (Leidy). The eggs and nits are afterward dislodged with saturated solutions of soda. Crusts are best softened with cod-liver oil. The eczema disappears with destruction of its cause.

Pediculus Pubis (morpio; crab louse) finds its habitat on any hairy surface except the head, but is especially at home at the pubes, whence it is derived in sexual congress, and where it may be seen on close inspection as a small brown speck near the skin. It has the same general construction as the Pediculus capitis, and the eggs are fastened to the hair, only close to the root, by the same chitin. The insect is effectually destroyed by mercury, best in the form of the white precipitate ointment. Two applications of the size of the end of the little finger will always suffice to relieve the itching, eczema, or other effect, with the eradication of the cause. When mercury itself produces eczema or is contra-indicated from any cause, it may be substituted by naphthol with olive oil 1:10, or creolin 1:50. The remedy should be applied with cotton at night, and the application should be repeated on the following night, whereupon on the next morning it may be washed off with soap. To destroy the young of subsequent growth, the application should be repeated at the end of one and two weeks.

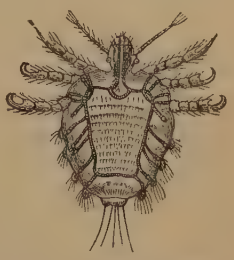


Fig. 5.—Pediculus pubis.

The most potent preparation for permanent cure—*i.e.*, to destroy nits and eggs—is (Saalfeld) :

℞ Hydrargyri bichloridi ..... gr. x.
Aceti communis..... ℥ viii.
M. S. Apply morning and evening for three days.

Pediculus Vestimenti (body louse; clothes louse).—The largest of all the lice, 3–5 × 1–2 mm. It has the same general construction as the species above described, but lives in the clothes, and leaves the folds and creases, in which it lies secreted, to suck blood from the body as food. The irritation thus produced is intensely aggravated by scratching, so that the skin is torn by the nails and the surface is literally lacerated in every direction. Urticaria, *excoriations*, *eczemata*, pustules, furuncles, and actual ulcers may form in these regions. Parts of the body which suffer most are surfaces of closest

contact with the clothes, as at the *back of the neck* and *shoulders*, *sacrum*, *nates*, *hips*, etc.; or regions of friction, as at the *waist*, *wrist*, *line of the garter*, etc. Continued irritation at these places leads to deposit of *pigment*, so that the affected surface may be deeply discolored. Infection is most extensive in the class of peripatetic pilgrims commonly known as tramps, but is not infrequently seen in the higher classes as accidentally contracted in hotels, sleeping cars, ship cabins, etc. Moreover, exterior and interior do not always correspond. Underclothing may be worn so long as to become a good breeding place after the slightest infection; the clothing may be clean and the bed foul, etc.

FIG. 6.—Pediculus vestimenti.

Treatment, to be effective, must be radical. The clothes, bedding, etc., must be burned, boiled, steamed, or subjected to dry heat at 212° F. for twenty-four to forty-eight hours, or, when this is not practicable, saturated for hours in a solution of sublimate 1 : 1000, or in crude petroleum. The surface irritation disappears with destruction of the cause.

ACARUS FOLLICULORUM, an elongated, 0.08×0.02 mm., worm-like body, with mandibles and four pairs of extremities on the upper third of the body, is found in the secretion of the oil and hair glands, especially of the nose, temples, cheeks, external ear, etc., and rendered visible under the lens after expression of the contents of the gland by the finger nails. These contents, of cheesy consistence, often with a top of black coal dust, flattened out under an object glass are seen to include, for the most part none at all, but at times one, or exceptionally more—in recorded cases as many as twenty—acari. The animal always lies head downward, and seems to be perfectly innocuous to man, though allied species do damage to the skin in lower animals.

FIG. 7.—Acarus folliculorum.

PULEX (the common flea) in its bite produces petechiæ with hyperæmic areola, which fades on pressure and soon disappears altogether, while the petechiæ persist for several days. The flea bites usually covered surfaces in light contact with the clothes, as the back, chest, thighs, etc. Confusion with petechial eruption is avoided by observance of the region affected—the legs in purpura, the lower abdomen in variola, the upper abdomen in typhoid fever, etc. The central blood point of the fresh flea bite, and the dark-brown or black specks which mark the deposit of fæces, suffice for diagnosis.

PULEX PENETRANS (the sand flea) is found along the coast

regions. The female penetrates the surface to suck blood and leave, in the course of three or four days, more severe inflammation of the skin. Erysipelas, lymphangitis, ulceration, gangrene, even tetanus, have been thus introduced.

CIMEX LECTULARIUS (the bedbug) makes distinctions, in that it selects certain individuals and spares others. It produces in sensitive subjects, especially infants, itching urticaria, eczema, and, in consequence of scratching, more or less extensive incrustation. The insect makes its excursions in search of food at night only, and attacks more especially exposed surfaces—face, neck, and arms. These points suffice for diagnosis.

MOSQUITOES, WASPS, BEES, HORNETS, or other FLIES, and other insects, may produce lesions of the skin by bites, by the deposit of eggs (maggots) in wounds, and, in the case of wasps and bees, by the insertion of poisonous matter. The history makes the diagnosis. The writer once failed to get a diagnosis from a class of students in the case of a patient semi-comatose with typhoid fever, one-half of whose face was thickly studded with papules while the other half was wholly free, the studded half having become exposed in the night from under the mosquito bar.

The application of dilute liquor ammoniæ 1 : 10, alcohol, or water with the addition of a few drops of carbolic acid or of creolin (one or two per cent), allays the irritation and neutralizes the poison of the bite.

VEGETABLE—DERMATOMYCOSES.

FAVUS (honeycomb) ; tinea favosa.—An affection, chiefly of the hairy scalp, produced by the growth of a mould fungus named by Remak in honor of Schönlein, its discoverer (1839), the Achorion Schönleinii. The disease begins as a papule penetrated by a hair. The papules grow gradually to the size of a ten-cent piece, flattening and sinking in the centre to form the characteristic saucer-shaped masses, scales, or cusps of sulphur-yellow color, the so-called scutula (dish). Crushed between the fingers the scales crumble, to emit a peculiar musty odor. Particles placed under the microscope show, with epidermis scales, hair fragments, detritus, etc., a wilderness of threads (mycelia) and spores (conidia), the cause of the disease.

FIG. 8.—Achorion Schönleinii from favus cup (Kaposi).

In the course of time the favus crusts coalesce to form a more uniform mass ; the invaded hairs lose their

lustre, appear as if powdered, become fragile, and are easily broken off or detached; in bad cases, where the papilla is attacked, they may be permanently destroyed. The surface, which is now converted into a mortar-like, dirty yellow mass (honeycomb), presents an appearance offensive to both sight and smell. Crusts, which were before so adherent as to be detached with hæmorrhage, now desquamate continuously and the color gradually changes to gray or brown.

The disease may in exceptional cases attack uncovered surfaces, and in still rarer cases invade the nails (onychomycosis favosa), which then show the same sulphur-yellow deposits with degeneration and detachment of nail substance. The characteristic elements of the

FIG. 9.—Favus scutulum: *a*, free border; *b*, corneal layer; *c*, *d*, mycelia; *e*, conidia; *f*, epithelium; *g*, papilla; *h*, cell infiltrate at base of scutulum; *i*, cutis (Neumann).

growth have been observed once (Kundrat, Kaposi) in matter voided from the stomach.

The disease is common to many domestic animals, especially to mice, rats, and cats, from the last of which it may be contracted, though infection usually comes from an affected bedfellow or from use of the same comb. It is not eminently contagious and may remain confined to one child in a family in close contact with others for years.

The *diagnosis* rests upon *the form of the favus crusts*, the *yellow color, the odor like that of mice*, the destruction of the hair; more positively upon the *presence of the parasite*, which is best displayed by the addition of a few drops of liquor potassæ and examination with glycerin. The diagnosis has been made easy since the discovery by Neisser that a favus crust *touched with alcohol is stained*

a deep yellow, a change which does not occur in crusts of eczema or other simulating affections.

Treatment.—The crusts must be softened with oils, that a parasiticide may be brought to bear directly upon the cause of the disease.

FIG. 10.—Hair and root sheaths in favus, infiltrated with conidia and mycelia.

In uncovered places saturation with cod-liver oil over night, and the subsequent application of carbolic acid, naphthol, resorcin, thymol, or sublimate, according to the following formulæ, suffice to control the disease. The disease is much more obstinate on hairy surfaces, and successful treatment demands epilation. After softening by

saturation over night with cod-liver oil under a flannel cap, the head should be thoroughly washed with soap liniment, dried, and all loose hairs extracted. Thereupon one of the following preparations must be rubbed into the scalp with a stiff brush, whereby it is not necessary to give pain:

1 ℞ Acidi carbolici ..... ʒ ss.
Olei olivæ ..... ℥ iv.
M.

2 ℞ Resorcin ..... ʒ i.
Unguenti petrolati ..... ℥ iv.
M.

3 ℞ Thymol ..... ʒ i.
Chloroform ..... ℥ ij.
Olei olivæ ..... ℥ iv.
M.

4 ℞ Unguenti hydrargyri ammoniati ..... ʒ ij.
Unguenti petrolati ..... ℥ ij.
M.

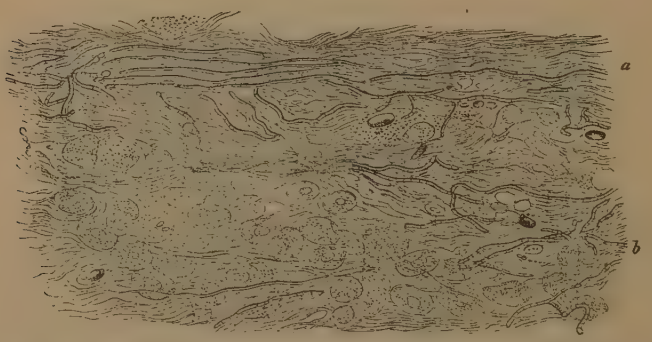


Fig. 11.—Epidermis scale in herpes tonsurans, showing more mycelia than conidia (Kaposi).

The most powerful parasiticides, when well borne, are pyrogallic acid ten per cent, or chrysarobin ten per cent, or alcoholic sublimate solution 1 : 100.

Herpes tonsurans (ἕρπης, creeping eruption; *tondeo*, to shear); herpes circinatus; ringworm.—A disease of both hairy and free surfaces, caused by the growth on and in the skin of the trichophyton (hair-like) tonsurans—long, narrow threads which divide but little, form no masses, but much more readily invade the hair.

The parasite is common to domestic animals, dogs, cats, cattle, between which and man the disease is transferable. It may be cultivated in beef infusions, on agar, potato, etc.

On the scalp it attacks and bends or breaks off the hairs, to leave partly bared, as if badly cut, or later bald, spots, smooth, scaly, or covered with pustules or crusts with more or less reddened edge. The hairs look dull and dusty, and the skin of the scalp is lightly infiltrated with serum and is slightly sensitive to pressure.

On a free surface the disease appears in small vesicles upon a reddened base. The vesicles rupture, to leave the red points covered with small scales. In the progress of the disease new vesicles develop in the form of a ring about the first set, while the original centre fades to leave no trace. The process repeats itself in this way with an advancing circular or serpentine wall of vesicles, or contiguous rings break into each other to aggravate the inflammation and show pustules, crusts, or more extensive eczema. Desquamation finally sheds the parasite, and the disease ceases spontaneously in six weeks to six months.

Fig. 12.—Hair in herpes tonsurans.

A good illustration of this process is often seen on delicate surfaces

Fig. 13.—Onychomycosis.

kept warm and moist by apposition, as where the skin of the scrotum rests upon the inner face of the thigh. Maceration with abrasion of the epidermis forms here a good nidus for the parasite, which advances with an outlying marginal ring of papules to constitute the affection known as eczema marginatum. The finer forms of myce-

lia sometimes found in this affection have received the name microsporon minutissimum.

The nails invaded by the parasite (onychomycosis tonsurans) become opaque, scaly, and brittle.

More extensive inflammation results at times from invasion of the hairs of the beard, with the formation of papules and pustules, which may coalesce to form ulcers with wide infiltration of the skin, constituting the condition known as the parasitic sycosis menti. The disease is contracted in barber shops. The common acne mentagra is also parasitic, but is produced by the Staphylococcus aureus.

Treatment.—During the stage of vesiculation or abrasion on a free surface, no other treatment is necessary than the use of some inert powder, as of starch, to prevent contact with air or with opposed surfaces. Later stages call for:

1 ℞ β-naphthol ..... 3 ss.
Saponis viridis ..... ʒ ii.
M.

2 ℞ Acidi pyrogallici ..... 3 i.
Unguenti petrolati ..... 3 x.
M.

3 ℞ Hydrargyri chloridi corrosivi, Aquæ destillatæ, 1:1000.
M. S.: Wash the surface three times a day.

On the hairy scalp successful treatment requires, in addition to softening of crusts with olive, almond, or cod-liver oil, removal of dead or diseased hairs, with subsequent destruction of the fungus by one of the parasiticides mentioned. Penn applies sublimate with electricity. The sponge of the positive pole is dipped into a three- to five-per-cent sublimate solution and applied to the affected region ten minutes with a current not too strong.

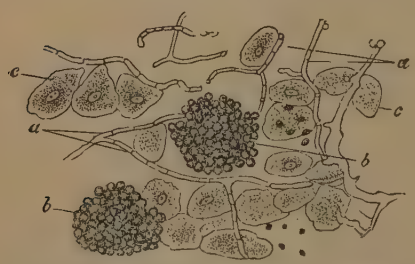


Fig 14.—Microsporon furfur: *a*, mycelium threads; *b*, conidia; *c*, epithelium.

Pityriasis versicolor is that discoloration of the surface, pretty uniformly yellow or brown, not so variegated as the name implies, which results from the deposit and growth of the microsporon furfur, a vegetable parasite distinguished only from those hitherto described by its smaller size and more superficial growth. It develops by preference upon warm, moist surfaces of the trunk, neck, flexures of the

joints, etc., and is most commonly seen on the skin over the pit of the stomach, especially in the uncleanly or phthisical, patients who sweat much. The discolorations vary in size from minute spots to tracts which may by spread or coalescence cover large regions of the body.

Treatment.—Friction with carbolic acid, sulphur, or naphthol soaps usually suffices to reach this parasite. The following is an eligible preparation:

℞ *β*-naphthol ..... gr. x,
Spiritus lavandulæ ..... ʒ i.
Saponis viridis. ..... ʒ i.
M.

Other forms of pityriasis—viz., rosacea, maculata, circinata—and various dermatomycoses—erythrasma, etc.—are produced by allied hyphomycetes. Carter considers the Madura disease, in which tumors

Fig. 15.—Pityriasis; mycelia and conidia.

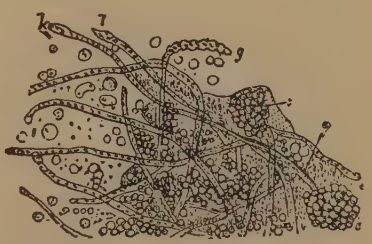


Fig. 16.—Mycoderma albicans.

and ulcers form on the hands and feet, the so-called fungus disease of India, as a mycetoma. Certain diseases of invertebrate anim ls are found to be due to fungi. The silkworm is destroyed by the muscardine, Botrytis Bassiana; the crab by penetration of its flesh by the Achyla prolifera; and the common house fly is killed by penetration of the mycelia of a species of empusa.

A transition from the external to the internal parasites is offered in thrush and actinomycosis—affections of the mucous membrane and deeper structures of the mouth.

Thrush (thrush; curd; German, *Soor;* French, *muguet*).—A superficial disease of the mucous membrane, mostly of the mouth, caused by the deposit and development of the thrush fungus (Mycoderma albicans), and characterized by the formation of white spots and surfaces non-adherent or but loosely adherent to the epithelial layer, clinically by sore mouth and dysphagia.

The thrush fungus was formerly regarded as the Oïdium albicans, but since it has been observed to grow by the budding process it is

classed among the ferment fungi and called the Mycoderma albicans. It is readily recognized by its mycelia and conidia, and may be cultivated on various soils. It has a wide distribution in nature, but not much affinity for the soils offered in the body of man, as it develops on the mucous membranes only of the weak and debilitated or in persons of unclean habits. It is found in the mouths of sucklings, especially in cases of gastro-intestinal catarrh or in cases of use of unclean utensils for food, especially unclean nursing bottles and nipples. It is seen also upon the breast nipples of nursing women careless as to cleanliness; and these two sources, the natural and artificial nipple, introduce the disease to the mouth of the child.

Fig. 17.—Transverse section of flake of coat of tongue after death in typhoid state, covered with mycoderma (Dickinson).

Typical cases are also encountered in the adult where the body has become debilitated by long-standing disease, typhoid fever, tuberculosis, diabetes, or any marasmus. In the last stages of tuberculosis the whole interior of the mouth and pharynx, as far as may be seen, may be lined with thrush.

The fungus is also found upon other mucosæ—larynx, œsophagus, stomach, vagina, glans penis, and rectum. It lies at first under and in the epidermic layer of the mucosa, but is speedily exposed by desquamation and is found mingled with epidermic scales, detritus, and the myriad bacteria of the mouth. Occasionally, as a great exception, it is carried by metastasis to distant organs. Thus Schmorl found it in the kidney, and Zenker (sole observation) in multiple abscesses in the brain. Such transfer is exceedingly rare, but the possibility of it has been proven in animals by Klemperer, who produced a general mycosis by injection of it into the blood of the rabbit. Aspirated into the lungs of man, it helps to produce the catarrhal (*Schluck*) pneumonia of paralyzed, reduced, debilitated (senile) patients.

Symptoms.—Thrush may be latent. In fact, most cases of light deposit hitherto unsuspected are recognized only by inspection—as of the process of dentition, for sore throat, etc. The disease shows itself at first as small pinhead deposits of white cheesy matter, bordered with a red ring, upon the surface. The points coalesce to form large surfaces, which may coat extensive areas or absolutely line the whole cavity. The deposits may be detached without much break of surface—*i.e.*, without hæmorrhage—to leave a lightly reddened, hard, slightly abraded base, which is tender to the touch. The secretions of the mouth are always acid, not, however, in a necessary relation to growth of the fungus, as Kehrer showed that it will thrive in solutions of the lactate of soda and potash.

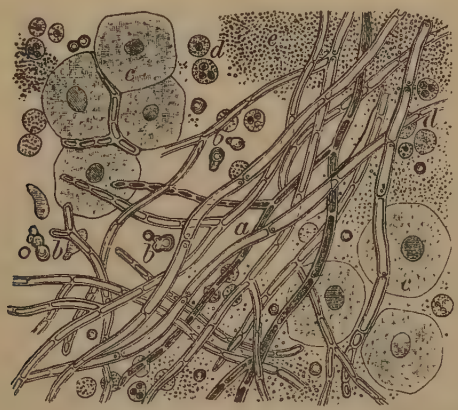


FIG. 18.—Thrush fungus: *a*, mycelia with polar granules; *b*, conidia; *c*, epithelium; *d*, leucocytes.

When present in any quantity it causes soreness of the mouth, with consequent aversion to food and at times even difficulty of deglutition.

Diagnosis.—The disease is usually recognized at a glance, even though the color may be changed, by admixture with food or foreign matter, to a dirty gray or brown. The deposit is confined to the surface of the tongue, cheeks, lips, or only later involves the throat, and then without the adenopathies which distinguish sore throat from other causes. In case of doubt the microscope reveals the true character of the deposit. The specimen, best examined in glycerin, shows leucocytes, detritus, conidia (spores), and threads with clear contents, each section of which contains two polar granules.

Treatment.—Prophylaxis is a main element. The disease may be avoided by care of the mouth and scrupulous attention to utensils, nursing bottles, nipples, etc., which should be boiled, steamed, and washed in soda. In fact, bottles and nipples should be dispensed

with as soon as possible. All expenditures of patience in feeding with the spoon and from a glass (not a cup, even though of silver or gold) will be thus amply rewarded. The oral cavity of patients with prostrating maladies (the tuberculous, etc.) must be cared for every day. The child's mouth may be best washed out with clean linen rags dipped in five- to ten-per-cent solutions of soda or borax. Deposits of thrush may be thus mechanically washed away, and the parasite itself dislodged and destroyed. The base may be touched with nitrate of silver (two-per-cent) or with—

℞ Potassii permanganatis..... .....gr. v.
Aquæ destillatæ..... ʒ i.
M. Apply with camel's-hair brush.

A very mild, safe, and efficacious remedy is methylene blue, two- or three-per-cent solution, applied with a brush.

Syrups, because they favor the development of fungi, should be always avoided in the preparation of any remedy for thrush.

The general health must be fortified by the tincture of iron, malt, cod-liver oil, fresh food, and open-air exercise.

The LEPTOTHRIX BUCCALIS is the common fungus which abundantly infests the mouth. It is found on the coat of the tongue ; on the teeth, to the caries of which it is said to contribute; and in the crypts, cheesy contents, of the tonsils, where it produces a form of tonsillitis which simulates in its deposits and symptoms a beginning diphtheria. The leptothrix may be always recognized by its mycelia. Under the iodine-potassium-iodide solution it takes on a purple color.

FIG. 19.—Leptothrix buccalis. From tartar of teeth.

ACTINOMYCOSIS (*ἀκτίς, ἀκτίνος*, ray, *μύκης*, fungus) ; big jaw, swelled head, bone tumor ; German, *Kinnbeule, Holzzunge, Knochenkrebs.*—A peculiar infection of cattle as well as man, caused by the ray fungus, actinomyces, characterized by development of the fungus in mass, with excessive overgrowth of the soil in which it grows, attended by metastases to different organs, marked by symptoms of pyæmia and marasmus, and distinguished always by the detection of particles of the fungus itself in the mass, in its metastases, and in its discharges.

History.—Bollinger (1877) first saw the fungus as the cause of the disease known as the big jaw in cattle. Israel, of Berlin, saw the parasite in man in the same year of its discovery in cattle, and described it as a new mycosis of man. Ponfick (1879) established the identity of the disease it caused in man with the actinomycosis of cattle. Belfield, of Chicago, first recognized the parasite in cattle in

our own country as the cause of the disease known as swelled head, technically as a jaw sarcoma.

Pathology.—Actinomyces constitutes a mass so large as to be visible to the naked eye. It consists of a conglomeration of innumerable threads of mycelia about a central mass of the same structure, from which the threads radiate in every direction to construct the ray shape. The mycelia can be always recognized by their clubbed extremities, and the mass, on an average about one-fortieth of an inch, is as large at times as one-tenth of an inch in diameter. Agglomerated masses may be as big as a fist. Fragments detached and discharged have a tallowy consistence and a distinctly greasy feel. Peripheral protrusions divide dichotomously, and show, as stated, distinctly clubbed- or pear-shaped extremities, to resemble in certain fragments the appearance of a hand or glove with outstretched fingers. The peripheral radiation from a central mass gives, under the microscope, something of the appearance of an aster

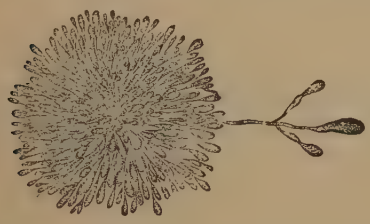


Fig. 20.

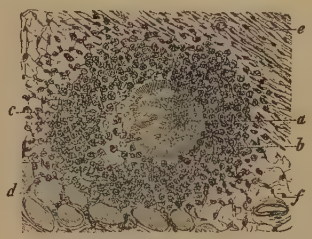


Fig. 21.

Fig. 20.—Actinomyces.

Fig. 21.—Actinomycosis of the tongue: *a*, actinomyces mass; *b*, cell masses; *c*, pus corpuscles; *d*, muscle tissue, cross-section; *e*, ditto, longitudinal section; *f*, blood vessel (Ziegler).

or sunflower. Many deviations, however, may occur from this classical type. The size of the individual mass may vary from barely visible granules up to masses of measurable diameter.

Besides the typical yellow color, particles may be seen colorless, transparent, greenish, or brown. The young granules are whitish-gray, the very youngest gelatinous, almost diffluent; the other colonies are opaque, and the oldest yellowish-brown and yellowish-green. The surface may be granulated, mulberry form. Harz and Johne tried in vain to cultivate it. Israel finally succeeded with coagulated blood serum, but with such different appearance from the normal structure as to make it impossible to decide upon the exact botanic relations of the microphyte. Boström succeeded best with granules floating free in pus or lying loose in granulation tissue. Wolff finally inoculated the disease with pure cultures of actinomyces. The mass is colored with difficulty, though the mycelia at the periphery absorb the aniline dyes, especially gentian violet, and retain

them. Fine pictures are made with double colorations, as by the method of Gram, and subsequent stain with eosine.

The pathology of the affection differs in man from that of the lower animals, in that the process in the animal is a local swelling, a so-called granulation tumor, while in man the tendency is toward a suppurative process with metastatic dissemination. So that the disease in man runs its course with the formation of multiple abscesses, under the picture of a chronic pyæmia. The difference is explained by the belief that the process is not pure in man, but is attended with mixed infections, especially with the penetration of the pyogenic micro-organisms. Of the nine cases reported by Baracz, in only one was there a pure actinomycosis; in all the others there was subsequent infection with the micro-organisms of pus. The suppurative process in man is attended also with a distinct tendency to extensive fatty degeneration. Preparations of the granulation tissue show great accumulations of fatty degenerated cells.

Etiology.—The most frequent avenue of entrance in man is, as stated, the cavity of the mouth, and especially the teeth whose surface is broken with caries; next the bones of the jaw; less frequently solutions of continuity in the pharynx and tonsils. More than half of all the cases hitherto observed in man have arisen in this way. The origin of the disease is ascribed to the ingestion of vegetable food, especially certain cereals (barley). The avenue of entrance in man bespeaks the same origin, that is, some vegetable source.

Symptoms.—The disease demonstrates itself as a *torpid* and but *slightly painful growth*, which finally perforates the skin with *sinuous tracts* and various *fistulous orifices*. Some, if not most, of the great tumors or masses in the region of the lower jaw, formerly diagnosticated as cases of angina Ludovici, which constituted in ancient times a much-dreaded malady, were certainly cases of actinomycosis of the lower jaw. Besides the penetration of the teeth, the parasite finds entrance into the body of man by way of the bronchi and also by way of the intestinal canal. Thus there is an actinomycosis of the jaw, of the lungs, and of the intestine. The disease distinguishes itself by its gradual encroachment upon tissues, hard and soft, in its vicinity. It *expands bone*, enlarges the natural outlines of the neck, converting the skin into a mass of cicatricial tissue, finds its way at times into the anterior mediastinum, and finally, after a lapse of months or years, causes the death of the individual by a slow *process of suppuration* or by a quicker *suffocation* or *occlusion* of larger vessels.

It may be distinguished upon the surface by the mass of cicatricial tissue, by the formation of *abscesses* with subsequent discharge without offensive odor, often through fistulæ of sinuous tracts, and

absolutely by its *yellowish granules*, of the size of grains of sand, visible to the naked eye, greasy to the feel, which, when placed under the microscope, reveal the distinctive characteristics of the growth.

Entering the bronchial tubes, it produces a peculiar form of *bronchitis*, most closely allied to putrid bronchitis, save that the offensive discharge which is expectorated separates into two instead of three layers—an upper supernatant, and a lower, turbid fluid containing the actinomyces. In the lungs proper the disease gives rise to the *symptoms of tuberculosis*, and has been not infrequently mistaken for this disease. The gradual decline of health and strength, the *progressive emaciation, cough, suppuration, night sweats*, make it closely resemble tuberculosis. In cases of more rapid progress the disease may *simulate pneumonia* with its glutinous, muco-purulent, or rusty sputa, dulness to percussion, and bronchial respiration. Metastatic processes from these centres disseminate the parasite to distant organs, most frequently to the subcutaneous and intermuscular connective tissue, and also to the various viscera —liver, kidneys, intestine, heart, and brain. The eruption into the various serous cavities—pleura, pericardium, peritoneum, meninges—quickly causes fatal inflammations. Cases which escape these calamities survive to succumb to *amyloid degeneration* with anasarca, and more protracted marasmus, whereby the disease may last two or three years.

In the intestine the mucous membrane shows whitish patches covered with yellowish granules, firmly adherent to the membrane upon which they rest. Various *swellings* appear, therefore, in its course, some of which suppurate and *discharge their contents* at times into the peritoneal sac, or by successive agglutination to the surface of the abdomen with subsequent free discharge. Metastases, which are rare on account of the size of the growth, carry fragments to the liver, where they may attain considerable magnitude. So metastases through the jugulars have developed into masses in the lung and heart.

Diagnosis.—The disease may be distinguished from ordinary affections of the jaw by its long duration, its tedious suppuration, its recurrence after incomplete exsection, its periods of quiescence, and defiance of all ordinary treatment. In the lungs it affects the posterior and lateral portions, rarely the apices, and in the intestine it reveals nodular masses which may at times be felt beneath the surface. But neither the enlargement, suppuration, nor general symptoms absolutely declare the disease, whose nature is only definitely established by the recognition of *fragments of the parasite* with the eye and its characteristic elements under the microscope. Certain apparently inscrutable cases of cryptogenetic infection have

been unveiled as actinomycoses. One of the most remarkable of these cases was that mentioned by Bollinger of an apparently primary actinomycosis of the brain. Fischer remarks that the presence of *vegetable fibres in the purulent discharges* should excite suspicion of the etiology of the disease.

Prophylaxis includes the supervision of the food of animals ; the avoidance of thorny and prickly twigs and plants, as well as of moist or wet food ; *the absolute destruction, as by fire, of all actinomyces* in diseased organs of slaughtered animals; and enjoins, above all things, *the most scrupulous care of the teeth and mouth.*

Treatment.—The treatment is almost entirely surgical. It consists in the complete exsection and enucleation of the entire mass with the knife, or its thorough eradication and destruction with caustic. The parasite seems to be singularly susceptible to the nitrate of silver. Köttnitz cured four cases with the solid stick, applied and inserted freely in every direction. Favorable results—*i.e.*, destruction of the growth and rescue of the patient—have been secured in individual cases by injection of the ferric sulphate, tincture of iodine, carbolic acid, or sublimate, as also by cauterization with the zinc chloride and the internal use of potassium iodide. Gautier reports the cure of a case by the electro-chemical treatment —*i.e.*, by the hypodermatic injection of a ten-per-cent solution of potassium iodide into the dead tissue, followed by the insertion of needle electrodes through which was passed a current of fifty milampères for twenty minutes. Billroth cured a refractory case with fifteen injections of tuberculin.

CHAPTER II.

ENTOZOA.

Of the whole number of the grosser parasites of man, now in the neighborhood of sixty, twenty-one occupy the interior of the body as the so-called *entozoa*. Most of these forms are so rarely found as to constitute clinical curiosities, and many of them have never been observed in our country. In fact, but four varieties—the tapeworm, the round worm, the threadworm, and the trichina—are so commonly encountered as to demand especial study by the practitioner of medicine.

Tapeworms (Latin, *tænia;* Greek, *ταίνια*, a band; cestodes, *κεστός*, belt, *εἶδος*, like).—Of the three hundred species of tæniæ in the whole animal kingdom, but four are found in the body of man, viz., in the order of frequency in our country, the Tænia saginata, armata, echinococcus, and lata, or Bothriocephalus latus, derived respectively from the ox, pig, dog, and fish.

History.—The first recognition of a difference in the varieties of tapeworm was made by Felix Plater (1602) with the discovery of the Bothriocephalus (*βόθρος*, a pit) latus, thus named by Rudolphi (1810). The Tænia mediocanellata or saginata was separated from the armata by Küchenmeister (1852). The Tænia echinococcus (*ἐχῖνος*, hedgehog) was first distinguished as a living thing by Pallas (1760), and its scolices (*σκολιος*, crooked) recognized as tapeworm heads by Pastor Göze (1782). Except in the case of the bothriocephalus, the larva of which has recently been discovered by Braun, of Dorpat, the development of the larval into the mature form, in all the varieties of tænia in man, was demonstrated by the feeding experiments of Beneden, Siebold, Leuckart, and more especially Küchenmeister, who verified his observations on animals in the bodies of criminals which he was permitted to use.

Anatomy, etc.—The whole animal in its maturity consists of a head (scolex), a slender neck which at some distance from the head shows transverse folds or wrinkles, deepening later or lower down into furrows, which indicate the separate segments (proglottides) of the body. The head of the tapeworm is oval, about the size of a

pin's head, and is provided with from two to four equidistant suckers about its upper surface. The segments, from four to twelve hundred in number, are at first longer than broad, then in some cases quadrate, and finally broader than long or extremely oblong. Upper are let into lower segments, and the union, firm at first, becomes more lax toward the end of the worm, where detachment readily occurs. New segments are always produced from the neck, so that the last segment is always the last so long as it remains united to the rest. Hence the necessity of securing the extrusion of the head in the total extirpation of the worm. Each segment contains or is filled with the generative apparatus of both sexes; hence the animal is hermaphrodite. It is also self-impregnating. The bulk of the segment is taken up by the uterus, which forms an elongated central cavity with radiating branches stuffed with eggs. The male element is comprised in a bunch of seminal vesicles which empty into a seminal duct terminating at a pore in the lateral margin of the segment, common to the uterine opening or vagina. These genital pores are disposed alternately, or on opposite sides of the different segments.

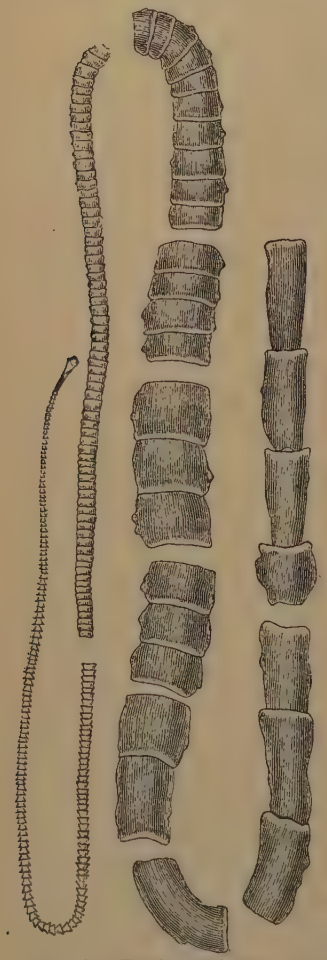


FIG. 22.—Tænia saginata; segments natural size.

The tapeworm fastens itself by its suckers to the mucous membrane of the small intestine, the body floating free in loose folds or elongated along the course of the canal, from the contents of which it imbibes nutrition by osmosis. The contents of the large intestine will not support it. Robin found one extending into the large intestine, the head fastened at the pylorus, the anterior end being rolled up into a coil as large as an apple. Portions found in the large intestine are in process of expulsion. It is feebly endowed with motion, so that detached segments voided with fæces may migrate by slow vermicular action a few feet from the seat of deposit. More extensive change of place is effected by outside agencies—running water, processes of manuring, wandering animals, etc. Each segment may contain as many as 53,000

eggs, so that a tapeworm producing 800 ripe segments a year may furnish an annual contribution of 42,000,000 eggs. Fortunately, in the struggle for existence myriads fail to find the necessary conditions for development; thus Leuckart calculates the chances of development of an egg to a cysticercus as 1 to 1,340, and to a mature worm as 1 to 85,000,000. The tapeworm may live in an intestinal canal from ten to fifteen years. Segments may retain vitality out of the body for ten years.

FIG. 23.—Segments in motion.

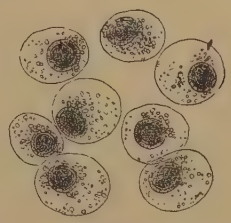


FIG. 24.—Ova containing embryos of Tænia saginata. × 350.

The egg of a tapeworm is a rounded or ovoid body provided with a thick envelope containing an embryo endowed with hooklets. Received into the body of an appropriate host, it is freed of its envelope by the action of the gastric juice, protrudes its head, and appears in the form of a larva. The larva is, of course, an undeveloped tapeworm. It has the same head and neck, much reduced in size, but

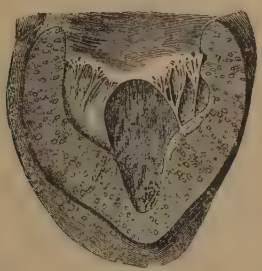


FIG. 25.

FIG. 26.

FIG. 25.—Calf's heart with measles of Tænia saginata
FIG. 26.—Cysticerci: *a* and *b*, of pig; *c*, of ox.

the body remains a vesicle. It is always provided with hooklets, by means of which it bores its way through the walls of the stomach or intestine, to be lodged in adjacent structures, or to be carried off by the lymph or blood current to distant organs, where it may excite a destructive inflammation, or, encysted, remain innocuous. The muscular structure of the body is the soil of predilection, and muscle thus affected is said to be "measly," from *measle*, a spot. In the course of three or four months the vesicle attains its full develop-

ment to the size of a large pea; the larva becomes a cysticercus. (κύστις, bladder, κέρκος, tail).

Cysticercus cellulosæ.—The pork tapeworm infests the body of man both in its mature form as the developed tapeworm, and the immature form as the cysticercus; but, as the liberation and development of the eggs of the segments may occur only accidentally in man, the presence of cysticerci is a rarity. Thus Karenski found them but nine times in eight thousand five hundred autopsies. Pigs which have access to the fæces of man are the natural hosts of cysticerci, and pigs thus infested show signs of disease, according to the location of the cysticerci. When present in great numbers (one pound of meat has been known to contain five hundred and forty cysticerci) the animal shows signs of general distress in progressive emaciation, œdema, falling of the bristles, etc.; stupor and convulsive attacks indicate infection of the brain; alterations in the sounds emitted, infection of the larynx; paresis and paralysis, invasion of the muscles of locomotion; dyspnœa, invasion of the diaphragm, etc. Cysticerci select by preference the psoas and iliacus muscles, the diaphragm, and the tongue—parts of the animal most prized as food. They may be seen on drawing out the tongue, studding its under surface like tubercles, which they were formerly considered to be. They show also in man the same predilection for muscular tissue, being found most frequently in the diaphragm, costal and cervical muscles, lying embedded in the intermuscular connective tissue, or floating in the pus of abscesses which they cause. Yet they are occasionally caught in the lymph and blood currents and carried to viscera, as to the brain (seventy-two times in five thousand three hundred examinations), eye, lungs, liver, kidneys, etc. They usually give rise to but little distress, being, as a rule, solitary, and, becoming soon encysted or calcified, they remain as foreign bodies during the life of their host. They have been seen in the eye with the ophthalmoscope, in the vitreous humor and under the conjunctiva or retina, which they detach and perforate. The pain and inflammation which they cause in this organ necessitate their extirpation, or, after failure of this operation, enucleation of the globe.

The cysticercus lives, as a rule, from three to six years, when it perishes and undergoes calcareous degeneration; but, ingested during its life into the stomach of man, it attaches itself to the small intestine, and reproduces segments which become sexually mature in the course of three or four months. Periods of quiescence may occur. Bettelheim records a case in which no segments were given off in the space of three years. Ordinarily but one tapeworm is found in the body of man, yet there are abundant instances of the presence of two or more of the same or different varieties at the

same time, or of their coincidence with other forms of intestinal worms. Of three hundred cases examined by Krabbe, Tænia saginata occurred one hundred and ninety times, always solitary; Tænia solium seventy-seven times, multiple in thirteen cases up to ten worms. Béranger-Féraud once found twelve in the body of one individual, and Kleefer, of Görlitz, records a case in which forty-one tæniæ were discharged with heads. Roux saw ninety Bothriocephali lati, half filling a vessel, voided at once from a healthy child; and Lister and Bötticher each report cases where one hundred were discharged, all, of course, small and young.

The different varieties of tapeworm may be readily distinguished. I. The *Tænia armata* (armed), or pork tapeworm; *Tænia solium*, from Syriac *schuschl-é* (chain), Arabic corruption *susl* or *sosl* (not from *solus*, alone, because less frequently found alone than any other form), is known by its coronet of from twenty-two to thirty-two hooklets—whence the name armata—on the circular rostel-

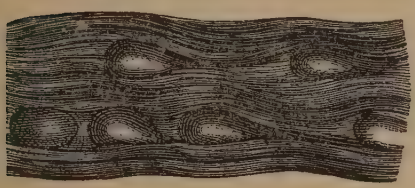


Fig. 27.—Measles in pork.

Fig. 28.—Pork tapeworm. Head with hooklets.

lum of its head, which is likewise provided with four small circular suckers. Its segments number from seven hundred and fifty to eight hundred and twenty-five, and become sexually mature at the four hundred and fiftieth member, as recognized by the presence of the genital pore, so that the worm may reach a length of from seven to ten feet. They are at first longer than broad, then quadrate, and finally extremely oblong, whence the synonym *cucurbitina*. They are rarely discharged except at stool. The uterus consists of a median cavity, never quite reaching the upper or lower margins, with from seven to twelve lateral branches, radiating irregularly like the branches of a tree—hence dentritic. Its larva, the Cysticercus cellulosa, provided with four suckers and six hooks, is found in the tissues of the pig, dog, deer, rat, sheep, ape, and bear, as well as in man in the liver, subcutaneous connective tissue, muscle, eye, and brain. Its circular ova contain also six hooklets. The Tænia armata is found wherever raw or half-cooked pork is used as food.

II. The *Tænia saginata* (fat), or beef tapeworm—erroneously called mediocanellata by its discoverer, the narrow, cylindrical ute-

rus having been mistaken for a median canal; sometimes still called lata because of its breadth—is known by its greater thickness and breadth, whence its name. Its head is larger and more square, and, being devoid of a rostellum and hooklets, more flat on the top. It has likewise four suckers (though there is of this species, as well as of the armata, a variety which has six). The whole worm, especially the head, is darker, from the presence of more pigment matter than the Tænia armata; the neck is shorter and broader. It is larger than the Tænia armata, its twelve hundred and more segments measuring from ten to fourteen feet. Each segment is broad and long, often one-half by one inch. The body of the uterus quite reaches the upper and lower margins of the segments; but it is more narrow than in the armata, and all its branches are finer. These lateral branches, more numerous than in the Tænia armata, fifteen to twenty-seven on the side of the genital pore, thirty-one on the opposite side, are always given off dichotomously. The segments are voided not only at stool,

Fig. 29.

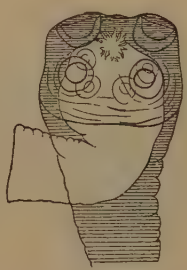


Fig. 30.

Fig. 29.—Head and neck of Tænia saginata.
Fig. 30.—Head of Tænia solium within that of Tænia saginata, to show differences (Heller).

but often also spontaneously. Acetic acid renders the segments translucent, and displays the uterus with many branches in the Tænia saginata, few in the Tænia armata. Patients who are continually or occasionally discovering detached fragments in their clothes are nearly always hosts of the Tænia saginata. Its larva is found in cattle and various other ruminants, but not in man. Its eggs, of which each segment may contain thirty-five thousand, are oval, larger than those of the Tænia armata, and devoid of hooklets. The Tænia saginata is found wherever rare or raw beef is used for food; consequently much more frequently in our country than the Tænia armata. The Tænia saginata is now the common tapeworm. Leidy states that the tapeworms from Philadelphia and its vicinity, which he had occasion to examine in the last twenty years, "perhaps in all about fifty," were specimens of the Tænia saginata. The condition assumes epidemic proportions in Abyssinia, where the flesh of cattle is eaten while still

quivering with life. Knox reports the existence of the condition in epidemic proportions in the English army during the Kaffir war. A mature worm was raised from a beef "measle," purposely swallowed by a student, in fifty-four days.

III. The *Tænia lata*, or Bothriocephalus latus, differs in marked degree from the preceding varieties. It is the largest of all the tapeworms, its four thousand segments attaining a length at times of twenty-five feet. The head is long and narrow, and is slit at the sides to form the bilateral elliptical suckers which give the worm its name. The segments, not sharply separated, are from two to four times as broad as they are long. The central uterus has the appearance of coils of intestine. The genital pore is situated on the ventral surface. The cysticercus is provided with spiculæ and a ciliated envelope, by means of which it swims in water. The eggs are oval, and are furnished with a lid (operculum) at one end to afford escape for the embryo. This species of tapeworm is found wherever raw or partially cooked fish is used as food; consequently in Russia and Sweden, East Prussia, Poland, and parts of Switzerland—not in our

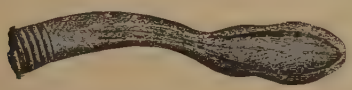


Fig. 31.—Head and neck of Tænia lata.

Fig. 32.—Ova of fish tapeworm.

country. The sole specimen thus far reported in our country was found by Leidy in the body of a recently immigrated Swede. The mature Tænia lata is found in the intestine of the dog as well as in man.

Symptoms.—Mature tapeworms are seldom dangerous to man. In many cases they produce no symptoms of any kind, and their presence is recognized for the first time upon the post-mortem table, or in the discharge of segments with the stools; the appearance of them in clothes at other times is the first indication of their presence. Individuals who use water closets may thus entertain these guests unawares, until on some occasion the fæces are voided visibly, as upon the ground in the open air, or in a night vessel. As no mature worm penetrates the intestinal canal or evolves noxious products, what symptoms do occur are due to mechanical irritation of the intestinal walls or are reflex manifestations. Thus, anorexia, nausea, vomiting, colic, diarrhœa, alternating perhaps with constipation, heartburn, pyrosis, flatulence, the group of symptoms characteristic of gastric catarrh, summed up under the vague term *dyspepsia*, and, as effects, lassitude with malaise and depression of spirits, are not infrequently present. A ravenous or insatiable appetite is excep-

tional, and when present is due, not to the consumption by the parasite of nourishment, which is insignificant in amount, but to reflex irritation or defective assimilation, the result of irritation. More importance may be attached to morning *vomiting*, which, in the absence of more common causes—pregnancy, gastric catarrh, cirrhosis, tuberculosis, Bright's disease, etc.—may be an index to the condition. Young children or highly sensitive adults may exhibit more pronounced *disturbances of the nervous system*. Thus dilatation of the pupils, itching of the nose and anus, palpitation of the heart, choreic manifestations, even veritable convulsions and epilepsy, have been observed in these cases. But the symptoms caused by intestinal parasites are exaggerated as a rule. All the symptoms mentioned may be produced by any cause that will excite the same irritation, and grave accidents are to be attributed to tapeworms only in cases where symptoms subside with the expulsion of the worms. Rare instances of this kind are recorded. Thus Williams describes the case of a young girl who was cured of a periodically recurring blindness and deafness of several hours' duration by the extirpation of a tapeworm; and Homolle reports a case of epilepsy relieved in the same way. Commini cured a case of epilepsy by causing the discharge of a tapeworm, which had been voiding segments spontaneously. The disease returned with the reappearance of eggs in the stools.

In a few cases grave symptoms admit of a different explanation; for especial danger attaches to the pork tapeworm, in that the deglutition of its eggs or their *premature discharge* into the intestinal canal may lead to the development of cysticerci in the same host. This accident may take place in sleep, when the hand is used to relieve itching or irritation at the anus, or the moist segments escaping at the anus and crawling about on the skin are grasped in order to relieve the unpleasant sensations. Küchenmeister often found fingers contaminated in this way. Cases of self-infection have also happened from careless handling of worms after their expulsion. Moreover, the act of vomiting may introduce segments into the stomach, where eggs may be liberated to develop into cysticerci. Seeger mentions six cases of ejection of tapeworms by the act of vomiting, and Rebsamen reported the case of a woman who withdrew a Tænia lata from her mouth with her fingers. Frankenhausen related a case of cysticercus in a patient who had previously vomited a tapeworm, and Lewis collected a number of such cases. In two of Graefe's cases of cysticercus of the eye, the patients, while hosts of the worms, had suffered from the vomiting of pregnancy; and in the case of cysticercus of the brain reported by Möller the patient had had a tapeworm expelled twenty years before death. Thus the

existence of severe *nervous symptoms* might awaken the suspicion of the presence of cysticerci. But examples of this kind are very rare. In the vast majority of cases grave nervous symptoms, which are not pure psychoses, are due to other and more obvious causes. As curiosities may be mentioned the escape of tapeworms through previous openings at the umbilicus, into the bladder, etc.

The *diagnosis* of tapeworm is sometimes quite obscure. The only positive proof of the existence of tapeworm in the body is the *presence of segments in the stools* or clothes. As in most cases eggs are not discharged in the intestines, it is very rare to find them in the stools. Where reasonable doubt exists, the administration of a cathartic, or of an anthelmintic to be followed by a cathartic, may secure the proofs. Foreign bodies, shreds of inspissated mucus, most frequently shown, are generally recognized by naked-eye inspection. Differentiation of the form of tapeworm is easily made. The segments are flattened by pressure upon the object glass and examined with a power of five hundred diameters, when the characteristic features of each form become apparent at a glance. Dried specimens should be first softened in water. Acetic acid, as stated, clears up an opaque field to make the uterus visible. The occasional evacuation of segments independently of stools, or the discovery of them in the clothes, speaks in favor of the Tænia saginata.

Tænia saginata. Tænia armata. Tænia lata.

Fig. 33.—Segments.

Prophylaxis.—The subjection of meat to a boiling temperature throughout its bulk effectually destroys all cysticerci, and thus positively prevents the development of tapeworm. The recognition of this fact with regard to the Trichina spiralis has already diminished the number of cases of pork tapeworm. Cleanliness is the factor of next importance. The Oriental custom of ablutions before each meal may be commended in this regard. Individuals affected with the disease should be enlightened as to the fact that they are possible sources of infection of others. Bettelheim speaks of having seen in a house of poverty and squalor segments of tapeworm deposited upon and crawling about the floor, furniture, and beds. Butchers, cooks, all persons employed in the preparation and distribution of meats, should be cautioned as to the necessity of cleanliness of hands, instruments, vessels, and clothing. To prevent infec-

tion of animals with eggs, habits of decency in regard to the deposit of fæces should be enforced, and check should be put upon the barbarous custom of promiscuous defecation. A Texas physician informed Leidy, of Philadelphia, to whom he had sent a piece of measly pork for examination, that all the pigs in the place were thus affected, and that there was not a privy in the whole village. In the administration of anthelmintics to the subjects of tapeworm selection should be made of such remedies as will not cause vomiting. Especial attention is to be paid in this regard to the relief of the vomiting of pregnancy. Physicians as well as patients need repeated injunction against the careless handling of tapeworms in their examinations. Specialists who have devoted a large part of their lives to the study of intestinal parasites become exceedingly careful in their manipulations. Küchenmeister states that he always handles tapeworms with two pairs of long forceps, seizing them as near the points as will secure firm purchase; and Cobbold warns against the danger of leaving specimens about, or carelessly throwing them away, with the emphatic injunction to destroy them by fire.

Treatment.—The Greek and Roman physicians possessed sixty remedies for the cure of tapeworm, and the number has been greatly increased in our day. But few of these agents, however, have stood the test of time. Such uncertainty has attended the use of most of them as to have left the treatment of the condition a fertile field for quacks. This uncertainty depends, however, upon the failure to observe a few precautions, the chief of which is the use only of fresh, and the avoidance of old or stale, drugs. A second precaution demands the evacuation of other contents of the bowels as effectually as may be, that the remedy used may come in direct contact with the worm. Elaborate preparatory or supplementary treatment is now, in the main, superfluous, but a light diet during the day, or, better, a fast, broken only by a cup of coffee or a glass of milk, should precede the administration of the remedy selected. These remedies may be ranked in efficacy as follows:

1. The bark of the pomegranate root, of which three ounces should be macerated in twelve ounces of water for from twelve to twenty-four hours, to be then reduced one-half under gentle heat. The whole quantity is to be taken in divided doses in the course of an hour. Pomegranate root, when fresh, remains the most effective of all anthelmintics, and would long since have excluded all others, did it not at times produce nausea, vomiting, and colicky pains. To avoid the first of these evils Bettelheim suggests the introduction of the infusion into the stomach by means of the stomach pump; and to obviate all of them Féraud recommends

pelletierine. an active alkaloid of the root, named in honor of the discoverer of quinine. One to two drachms of the infusion of senna are to be taken on the morning following a day of fasting, and in the course of an hour fully as much as five grains of the tannate of pelletierine suspended in water. The tannate is preferred because of its slow absorption. Half an hour later the dose is repeated, to be followed in another half-hour with a tablespoonful of castor oil, the patient remaining meanwhile quiet in bed to avoid disturbance of the stomach. In one instance twelve tapeworms were expelled at once in this way.

2. Turpentine is a powerful tæniacide, but the use of it is liable to cause headache, pain in the stomach, fever, and strangury. These effects are, however, much less frequent after large than after small doses. Hence the dose for an adult should be never less than one or two ounces, for a child from one drachm to one ounce, according to age. It may be administered in emulsion with white of egg, or be briskly stirred in half a glass of milk and swallowed rapidly; should it fail to act as a cathartic, it should be followed with a dose of castor oil.

3. Male fern, the ethereal extract, two drachms in four or five gelatin capsules, of which one may be swallowed every five minutes with the aid of a cup of coffee. A dose of calomel with brandy should follow the capsules in the course of half an hour. Since the poisonous principle of male fern is soluble in oils and is thus rendered absorbable, calomel and not castor oil should be given as a purgative to secure the extrusion of the parasite.

4. Thymol (which is both a tæniacide and a tæniafuge), two drachms in twelve doses, one every quarter of an hour, preceded the evening before, and followed one half-hour after the last dose, by half an ounce of castor oil. Alcohol in some form should be given with it or after it to counteract its depressant effects.

5. Kousso, koussin, pumpkin seeds, santonin, kamala, carbolic acid, and zinc are other parasiticides of less value.

The discharges should be passed for several days in a vessel of warm water, and all fragments be brought to the physician, that he may positively recognize the head of the worm. In no case should traction be made during the passage of the worm. Full discharge can be readily effected during the evacuation by the injection of warm water.

Every attempt at treatment being a forcible intervention, only such individuals should be subjected to it as are known to be affected. The mere statement of a patient is not sufficient proof, and cases of tæniaphobia do not justify it, on so-called psychological grounds, because failures only aggravate the condition as a rule.

Pregnancy, advanced age, debility from any cause, are contra-indications to all treatment.

Finally, the physician must be awake to cases of deception. Everything found in a vessel does not necessarily escape from the bowels, and the same vessel is sometimes used by others. Bremsen says he once found in a vessel a pair of snuffers. Heller reports the case of a child finally debilitated by repeated treatment because of the continued exhibition of real segments of tapeworm, when upon closer examination it turned out that the fragments did not come from the child at all, but from a lazy nurse who made a convenience of the child's stool-chair.

IV. The *Tænia echinococcus*, dog tapeworm—hydatid tapeworm, bladder worm—is the smallest of all the tapeworms, measuring but one-fourth of an inch in length. It lives in the mature state in the dog, wolf, and jackal, but not in man. The head resembles that of a diminutive Tænia armata, in that it is furnished with four suckers, a rostellum, and a double row of hooklets. The segments, in number but four, progressively increase in size to the last, which is as large as all the rest, and which is alone mature. This tænia exists at times in such numbers in the intestine of the dog as to have been mistaken for intestinal villi.

The larva (echinococcus) of this tænia, which infests man and many of the herbivora, horse, ox, sheep, etc., differs from that of all other tapeworms in that it is endowed with the property of self-multiplication to a degree limited only by the restraint of outside pressure. The eggs, issuing from the anus of the dog and brought often in contact with the nose and mouth of this animal, may be thence received into the mouth and stomach of man, where the six-hooked embryo is liberated to penetrate the walls of the intestine and emigrate to various parts of the body. Infection of man usually occurs from drinking water, raw vegetables, etc., contaminated with dogs' fæces, or from the hair licked by the animal and stroked by man. From the fact that the liver is found infested more frequently than all the other organs together, sixty-nine per cent of cases, the inference is natural that the embryo is carried thither by the portal vein. Measly liver fed to dogs reproduces the Tænia echinococcus in the intestine of the dog. Having reached its destination, in whatever organ, including the bones, preferably viscera, the echinococcus develops the hydatid tumor, which may consist of a single cyst or, by proliferation from its inner wall, of multiple daughter cysts, or from them, in turn, of granddaughter cysts to the number of many hundreds.

The fluid of hydatid cysts is naturally clear and limpid, though it may be rendered turbid, opaque, or sanguineous by accidental

admixture of pus and blood. It is distinguished, when clear, by the presence of common salt and the absence of albumin. The echinococcus is rare in our country. But it is safe to say that the majority of cases in our country do not find their way into print. For in-

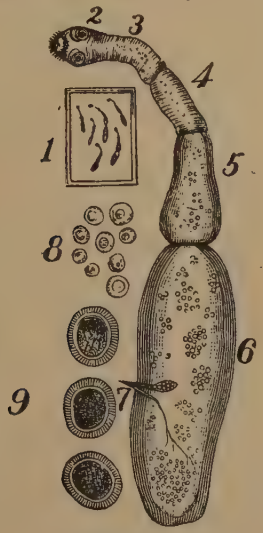


Fig. 34.

Fig. 35.

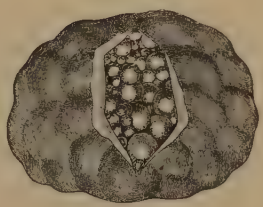


Fig. 36.

Fig. 34.—Tænia echinococcus: 1, natural size; 2, head; 3, neck; 4, 5, immature segments; 6, mature segments; 7, genital pore; 8, ova, 9, containing larvæ.

Fig. 35.—Extended echinococcus with hooklets.

Fig. 36.—Echinococcus sacs in the liver of man.

stance, a pathologist at the Cincinnati Hospital, a thoroughly competent observer, informed the writer, on the occasion of reporting the only case which had occurred in his practice of twenty-six years, that he had himself seen three cases since the beginning of his service, less than two years, none of which had been reported. It is common in countries where the dog is a most intimate companion of man. In Iceland, where the dog shares with man both bed and board, the disease is epidemic, one-fifth of all sheep and one-seventh of mankind being thus affected, females, from their indoor life, oftener than males. Victoria, Australia, vies with Iceland in the frequency of the disease. Krabbe, of Copenhagen, found twenty-eight per cent of five hundred dogs affected with Tænia echinococcus.

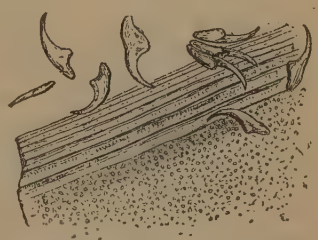


Fig. 37.—Echinococcus membrane with hooks.

The echinococcus is enveloped in a dense, impermeable, elastic capsule, which, upon section, rolls up at its edges to furnish a diagnostic point of great value. From the inner surface of this capsule new echinococci develop with characteristic scolices and hooklets.

Diagnosis.—The microscope reveals these structures, *shreds of membrane, scolices, or hooklets,* in the fluid of about half the cases. The recognition of them makes the diagnosis infallible. The other half of all cases must be diagnosticated by chemical analysis, a means of examination which applies to nearly all cases. Suspicion may be excited in the first place by the situation of the tumor. Echinococci, unlike cysticerci, avoid muscular tissue, and come to be lodged as a rule in certain viscera, preferably in the liver, lungs, spleen, brain, eye (orbit, but not in the ball), and kidneys. The anatomical elements mentioned have been discovered in the fæces, vomited matter, urine, sputum, or in surface fluid from spontaneously ruptured sacs, most commonly in the fluid withdrawn by aspiration. The growth of the tumor is slow, extending at times over periods of from ten to fifteen, exceptionally to fifty-five, years. Years of latency may follow the infection. It is not malignant, and is seldom painful; its symptoms being produced mainly by pressure upon, and dislocation of, natural structures. The tumor, when it may be percussed, palpated, or grasped, is found to be elastic, with a sense of semi-fluctuation. It develops on palpation also a peculiar *fremitus*, the so-called hydatid purring—a sensation similar to that felt in stroking a cat, or striking the spiral spring of a sofa or a bass chord of the pianoforte. Opinions differ as to the value of this so-called hydatid fremitus, which was first remarked by Briançon in 1828. Skoda claims that the same sensation is yielded by every sac with fluid contents and elastic walls. Cobbold does not think it different from the impulse communicated by fluid matter in any other kind of tumor. Bamberger, finding it in ascites and ovarian tumors, does not consider it characteristic. On the other hand, Heller and most French authors regard it as almost pathognomonic. Frerichs found it in but half his examinations. Tillaux maintains that it is caused by the impulse of daughter sacs upon each other in the absence of liquid in the parent sac. When the parent sac contains fluid in which the daughter sacs swim, there is no tremor.

As already stated, chemistry furnishes the surest means of diagnosis. The fluid is colorless, opalescent, neutral, and has a specific gravity of 1.005 to 1.015. Albumin is wanting, or is present in but very slight amount, although it begins to abound after frequent tappings. The test is satisfactorily made by heat or nitric acid. Common salt is abundant. A solution of the silver nitrate distinctly precipitates the insoluble chloride. In doubtful cases there remain two other tests of almost equal value, viz., the detection of succinic acid and inosite or muscle sugar. Both of these agents are found naturally in other organs of the body, but not in the liver;

hence the value of the evidence furnished by their presence in this organ.

It need scarcely be stated that while the absence of succinic acid and inosite does not exclude echinococcus, the presence of them is strong evidence of its existence. In general, it may be said that the chemical tests are more valuable than the microscopic, though the latter are more positive when present.

With all these means of recognition, the echinococcus cyst often escapes detection. Echinococcus of the brain may simulate typhoid fever; in long bones it develops spontaneous fracture rather than tumor. Thierfelder states that but seven of thirteen cases were recognized during life at Rostock; Brücke declares that but thirteen of twenty-two cases were discovered at the Berlin Charité; and Madelung maintains that, as a rule, but one-third of all the cases are diagnosticated. Most of these observations, however, antedate the days of aspiration, which has immensely simplified the examination.

Echinococcus cysts are not amenable to relief by internal medication. If further evidence than the failure of every kind of drug were necessary to prove this fact, it may be found in an observation of Leidy, who discovered in the body of an English sailor sent to him for dissection, the tissues having been thoroughly bleached by an injection of zinc chloride several days after death, a hydatid tumor of the size of the fist in the right iliac region, full of daughter cysts containing still living scolices.

The most simple method of treatment of echinococcus cysts is by aspiration of their contents. Murchison reported, of forty-six cases thus treated, thirty-five successful results. In ten cases subsequent suppuration necessitated incision, whereby eight cases recovered and two died. The remaining case died of acute peritonitis in twenty-four hours. Fagg, Hilton, Durham, and Handfield report nine cases cured by electrolysis. Jansen, of Iceland, still adheres to the plan of opening by the caustic method of Récamier. Loreta (1886) first successfully resected a large part of the left lobe of the liver stuffed with echinococci. Radical treatment demands laparotomy incision and drainage under asepsis. Mudd successfully cut out an echinococcus cyst protruding as a tumor from the brain.

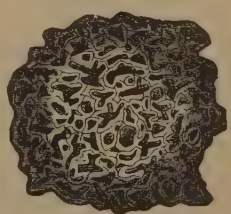


Fig. 38. — Echinococcus multilocularis.

The rare form of degeneration known as the *multilocular cyst* was first differentiated from colloid cancer in 1856 by Virchow, who showed its parasitic nature. Vierordt, who has been able to collect in all seventy-nine cases, some of them antedating Virchow's disclosures, makes the curious discovery that the disease is limited to a

very circumscribed geographical area. Of the seventy-nine cases, sixty-eight occurred in Würtemberg, Bavaria, and Switzerland, the rest in Baden, Austria, and Russia, and one in the United States. Strange to relate, no case has ever been reported from the classic centres of Echinococcus hydatinosus, Iceland and Australia. All the victims were adults. The duration of the disease averages from one to two years, in one exception eleven years. It is recognized by the anatomical elements of the parasites, as in the other form of the disease. From its exogenous character there is no tendency to capsulation and no hope of securing its total extirpation ; hence the prognosis is, as yet at least, always fatal. Multilocular echinococcus is by no means to be confounded with exogenous hydatid cysts, in which projections of brood capsules occur external to the parent membrane, penetrating the liver or other viscus at times in every direction. Such cysts are known as compound cysts, in distinction from the multilocular cysts, which give to the organ invaded a honeycomb appearance. The prognosis of the compound or exogenous cyst is much more grave than that of the simple or endogenous cyst, on account of the inaccessibility of many, or most, of the growths.

Fig. 39.—Ascaris lumbricoides.

Round Worms.—Nematoid (νῆμα, a thread) worms are represented as pathogenic entozoa of the human body in the round worm, the threadworm, the anchylostoma, and the trichina spiralis. The order, higher in the scale of life than the cestodes, is characterized by an elongated, filiform body without circulatory or respiratory apparatus, but generally provided with an intestine open at both ends. The sexes are separate.

The Round Worm, Ascaris lumbricoides—a sluggish worm, inappropriately designated ascaris, as it is much less active than the threadworm ; surnamed lumbricoid, *à lubricitate* (Hooper), from its slipperiness; coarsely resembling the common earthworm, which seems to have been named for it—is the most common, as it is the most prolific, of all intestinal parasites. It is also found everywhere over the globe. It is cylindrical in shape, with pointed ends, pale red in

color during life, paler than the common earthworm, pinkish-gray after death, averaging the diameter of a goose quill; the female, measuring in length fifteen inches with a capacity of extension to twenty-four inches, is twice as long as the male. The head tapers to a point more gradually than the tail, which, in the male, is distinguished by its direct incurvation to a hook-like process for grasping the female. A pair of white, delicate hairs, the protruding penis, are often visible on the ventral aspect near the tail; the vulvar opening is situated at the junction of the first and middle thirds of the body. The head is further characterized by three semicircular, knob-like projections about the triangular opening of the mouth, whereby it is readily distinguished from the earthworm, sometimes shown in attempted deception, which has a rounded head with the mouth under it in the form of a transverse slit. Vacuoles in the muscular meshwork of the skin give issue to a pale-red, oily, irritating matter of a peculiar odor, which is so persistent as to remain with the worm after thorough washing, and communicate itself in time to alcohol in which these worms have been preserved. The bulk of the body is taken up by the genital apparatus, one female developing sixty-two million eggs. The ova, $\frac{1}{330}$ to $\frac{1}{440}$ of an inch in diameter, provided with a thick, firm albuminous shell or envelope, of nodular surface, usually stained with bile, offer extraordinary resistance to destructive agents. Thus they may withstand desiccation for months, or remain a long time without injury to the embryo in alcohol, turpentine, chromic acid, etc., agents which quickly kill the mature worm. They are voided in quantity with the fæces, and may be counted by hundreds with a low power under the microscope in a small mass of fæces.

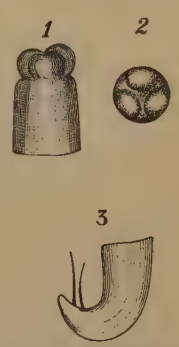


FIG. 40.—Round worm: 1, head from side; 2, from top; 3, tail of male.

Although Hippocrates was familiar with and described this parasite, the mode of development of the egg to the worm has been but recently determined. Impure drinking water has always been supposed to convey the parasite or its ova to the body of man; and recent observations by Grassi, Lutz, and Leuckart confirm this view. Aside from impure water, the disease is conveyed by dirt, mud, sand contaminated with fæces, and but rarely and accidentally by food, as fruits and salads. Infection begins in childhood with the first attempts at walking, infants being comparatively exempt. It never prevails extensively, nor are numerous ascarides ever encountered, in denizens of cities with good water supply. It is much more frequent in the country and small towns, and if most prevalent in the tropics, which seems to be the case, it is because of the greater

neglect of the water supply. The insane, whose habits are notoriously unclean (coprophagi), are infected as a rule.

The round worm dwells in the small intestine, usually about the middle of it, lying stretched out in its course. But a single worm may be present, more commonly from four to six, more rarely great numbers. Cruveilhier once counted a thousand. They cannot live in the stomach or colon, and, when found in either place, are in process of extrusion. They have no power of effecting perforation, but may migrate into natural openings in the intestinal canal, as into the gall ducts, pancreatic ducts, vermiform appendix, or, during the act of vomiting, into the larynx—where they have caused fatal suffocation—bronchi, nares, and thence into the tear ducts and into the Eustachian tubes, whence they may escape, through a previous perforation of the drum membrane, into the external ear. Thus Kartulis found, in a fatal case, one hundred and twenty in the small intestine, twenty in the large intestine, twenty in the stomach, three in the common bile ducts, three in the hepatic duct, five in the gall bladder, and sixty in the liver—all in the liver the seat of abscesses. Most of the migrations occur, however, after the death of their host. Such massive accumulations as to cause more or less complete occlusion of the intestine are also for the most part, though not always, post-mortem phenomena. Escape into the peritoneal cavity presupposes a perforation of the intestine, as from typhoid fever, tuberculosis, etc. So, also, worm abscesses, accumulations of pus containing worms, occur at the site of herniæ, at the umbilicus in childhood, in the groin in adults. Incarcerated with other contents of the bowel, the worm escapes through some perforation in its wall, the result of an inflammation to the cause of which the worm may possibly contribute chemically; as Huber noticed in himself, after handling these worms, itching of the head and neck, wheal-like formations on the skin, swelling of the ear, conjunctivitis, and chemosis. It is observed also that worm abscesses speedily heal after evacuation of the pus and discharge of the worm.

Symptoms.—Round worms frequently exist in the body without symptoms. In Grassi's case a boy aged seven voided, two months after taking a pill containing one hundred and fifty ova, one hundred and forty-three mature worms, showing meanwhile no symptoms whatever. The *discharge of the worm* is thus often the first and only sign of its presence. It is often an independent catarrh of the intestine which sickens and discharges the worm, so that, as Küchenmeister remarks, "host and guest agree very well together" as a rule. On the other hand, there may be due to the worm dyspeptic manifestations, *anorexia, heartburn, colic, constipation or diarrhœa, with puffiness of the eyelids, discoloration about the eyes,*

itching of the nose and anus, etc. The symptoms are wholly due to local irritations, which display the same symptoms from any cause. Various nervous disorders, paræsthesiæ, chorea, epilepsy, have been attributed to these worms, but, as in the case of tape-worms, without foundation as a rule. Disappearance of the symptoms with extrusion of the worm would be the only proof of such dependence.

The *diagnosis* rests, as has been said, presumptively upon the discharge of one worm, when others may be supposed to exist; or upon the discovery of ova in the fæces, which infallibly indicates the continued presence of the worm in the bowel. All other symptoms are fallacious.

Prophylaxis.—A supply of pure water is the best preventive. So long as doubt pertains to drinking water the precaution should be taken to filter it properly. The ova of no intestinal parasite will pass through a filter of porous clay. Children should be kept out of the dirt, or at least some care should be exercised regarding the source of the sand and dirt in which they play. They should be taught not to taste the "mud pies" they make.

Treatment.—Santonin is the best parasiticide. It is best administered in doses of from two to five grains suspended in castor oil, as it kills, but does not expel, the worm; or in capsule, compressed disc, troche, or powder with sugar of milk, equal quantity, followed by a dose of castor oil ʒ i.–ʒ i., or calomel gr. ij.–v. It should be given at night, every night or every other night, three times, that the patient be not disturbed by the blue or yellow vision which it sometimes occasions. Transitory dysuria, incontinence of urine, and, in very nervous subjects, even light delirium, rarely ensue. Where this remedy would seem to be contra-indicated it may be best substituted by thymol, one to two drachms, in divided doses given in quick succession, and followed by wine, whiskey, or brandy to counteract any depressing effects.

THREADWORM.—Oxyuris (ὀξύς, sharp, οὐρά, tail, characteristic only of the female) vermicularis, from its size and shape; the thread, pin, from its situation, seat; or from its activity, spring worm, is found only in the lower part of the large intestine of man, in which it spends its whole existence. The female, two-fifths of an inch in length, is readily recognized by its long, awl-like, slightly wavy tail and chalky-white color, the color of the eggs with which the body is stuffed appearing through its translucent envelope or skin. The orifice of the vulva is near the middle of the body. The male measures but one-tenth of an inch, is blunt at both ends, and incurvated at the tail for grasp of the female. The penis consists of a single spiculum, often seen projecting near the tail. Males, rare

in number and small in size, were for a long time overlooked, and are best discovered in scrapings of the intestinal mucus. The habitat of the threadworm is the cæcum, and not the rectum as is commonly believed. Ignorance of this fact accounts for the frequent failure of treatment. Threadworms are ubiquitous, occur at all ages, but are more frequent among the poor and unclean, and especially among children. Young worms begin to pass from the rectum in fourteen days after ingestion of the ova; and as each female may give issue to successive crops, though the duration of individual life is short, the progeny is maintained often throughout the life of the host.

FIG. 41.—Oxyuris vermicularis.

The eggs, $\frac{1}{600} \times \frac{1}{1200}$ inch in diameter, are oval and plano-convex. The embryo develops rapidly, in from four to six hours, so that the whole process may be easily followed up with the microscope. The myriad ova and rapid development render self-infection almost unavoidable. In fact, ova are always to be found insinuated (by scratching) under the finger nails of infected individuals. Helminthologists become infected in handling the worms.

Threadworms, though active in movement, have little power of migration over a dry surface, perishing rapidly after leaving the bowel; hence infection from contact, as from a bedfellow who happens to be the host of worms, cannot occur. The introduction of ripe ova from an infected individual into the stomach is an essential factor in etiology. Infected mothers, nurses, cooks, waiters, etc., generally convey the ova. Biting the nails is a not uncommon mode of reinfection. Orphan and insane asylums furnish all the prerequisites for rapid dissemination.

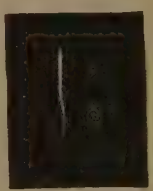


FIG. 42. — Oxyuris vermicularis, natural size; one female, two males.

Symptoms.—So long as the parasite remains above the rectum it gives rise to no symptoms. Descent of the mature female into the rectum to discharge its ova and escape at the anus—which occurs most frequently at night, on account of the quiet of the body at night and the greater warmth of the bed—is attended with *itching, boring, burning sensations,* which may become so intolerable as to prevent sleep and lead thereby to nervous distress. Migration into the vagina extends the surface of irritation, and may induce pruritus, masturbation, and nymphomania. It is questionable if the

worm ever finds its way beneath the prepuce or into the male urethra, though it may be carried thither by the fingers. The intense irritation about the perineum, with manipulations for its relief, may of themselves excite the genital apparatus and thus lead to a train of nervous disorders.

Diagnosis.—Direct inspection of the anus, more especially after the use of an enema, discloses oxyurides in numbers, so that a search for the ova is generally superfluous. The ova may, however, always be found, in the absence of visible worms, in scrapings of the upper parts of the anus, as everted in defecation, upon paper used in wiping, or in its uppermost parts accessible to the handle of a scalpel or the eye of a catheter. Vix declares that he never found a single case where the eggs were not visible in countless numbers in the first field of vision. The detection of the worm or its ova, it is needless to state, affords the only positive diagnosis.

Prophylaxis.—Scrupulous cleanliness on the part of those affected, regular ablutions before meals, and the frequent use of the nail brush, are preventive measures of importance. Children cannot be prevented from putting their own fingers in their mouths, but surely the filthy habit might be stopped of inserting those of their attendants. The bad habit of biting the nails can be broken up. After all, the only real prophylaxis is the speedy evacuation of every member of the colony in affected individuals.

Treatment.—Though some degree of moisture is necessary to the growth and reproduction of the threadworm, it cannot live in water, which causes it to swell up and burst. Hence the administration of anthelmintics is unnecessary and, because of the distance of the worms from the mouth, inefficacious. Heller saw oxyurides creeping about "quite lively" under strong solutions of carbolic acid applied as a dressing to condylomata of the perineum. Inundation and maceration with water, if practised effectively, suffice to destroy and remove them. Simple as it may seem to accomplish it, the treatment is nevertheless seldom successful. Failure is due to the fact that the applications are limited to the rectum. Irrigation with soap and water, because less irritant to the bowels than simple water, by means of a long rectal tube or catheter in the knee-elbow posture, best dislodges and discharges these worms. Irrigation with lukewarm water, two to four quarts, should precede the injection of the same quantity of soap water, and the operation should be repeated at intervals of one or two weeks, at least three times, that subsequent broods, previously secreted in the sacculi of the intestine or vermiform appendix, may be successively attacked. Ammoniated mercurial ointment best relieves subsequent itching and irritation about the perineum.

WHIPWORM.—Trichocephalus dispar (*θρίξ, τριχός*, hair, *κεφαλή*, head; *dispar*, unequal), male one and a quarter, female two inches in length; is readily recognized by the inequality of its thickness, the head extremity constituting a long, spirally turned thread, the lash; the body a much stouter, shorter mass, the handle of the whip; habitat, the cæcum and its vicinity. The brownish-colored eggs, 0.05 × 0.02 mm., which are not infrequently voided in the stools, are differentiated from those of other nematoids by their double contour, strongly granulated yolk, and distinct lemon shape, which is more closely simulated at both (flattened) poles by projecting (shining) coverlets. The eggs are developed into mature worms in the body of man. The whipworm, which may furnish one and a half million eggs in twenty-four hours, indicating the presence of nine hundred to fifteen hundred parasites, is, according to Moosbrügger and Leichtenstern, a frequent cause of anæmia and blood-stained diarrhœa in children.

FIG. 43. — Whipworm, female and male.

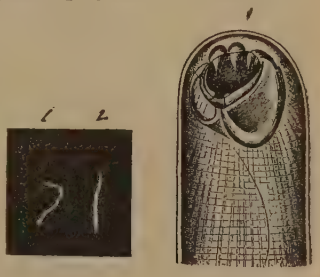
ANCHYLOSTOMA (*ἀγκύλος στόμα*, fixed mouth) DUODENALIS; Gothard worm, from the number of cases (over one thousand reported) among the workmen in the excavation of this tunnel.—A thick, red,

FIG. 44.—Eggs of entozoa: 1, Distoma hepaticum; 2, Distoma lanceolatum; 3, Tænia solium; 4, Tænia saginata; 5, Tænia lata; 6, Oxyuris vermicularis; 7, Trichocephalus dispar; 8, Ascaris lumbricoides.

round worm, female one-half to three-quarters of an inch long, male half as long; it is distinguished by an open, oval stoma, lined with teeth, by means of which it attaches itself by hundreds and thousands to the duodenum and jejunum, penetrating even to the submucous tissue, where it sucks itself, like a leech, full of blood. It is found in Egypt, parts of Europe, South America. and Africa, whence it was imported by slaves into our own Southern States, Louisiana, Alabama, and Georgia. The oval ova, 0.05 mm. long, are voided in

the intestines to be discharged with the fæces and continue their growth in stagnant water, whence they are received into the intestine of man, in which development is completed.

The *symptoms*, which show themselves in acute and chronic forms of anchylostomiasis, depend mainly upon *loss of blood*. The disease is announced in both forms with *pain in the stomach and intestines*, to be followed by *anæmia and chlorosis*. The lips and finger nails become pale, the pulse is increased in frequency, and in chronic forms there is either marked hypertrophy and dilatation of the heart or disturbance of valvular action. In the last stages of the disease *anæmia* becomes profound and *œdema* begins to show itself about the ankles and legs. Fatty degeneration of the heart, with *stasis, cyanosis, and dropsy*, gradually supervenes in the cases of more protracted course.



1, male: 2, female. ¾ natural size. 3, magnified head, showing teeth.

Fig. 45.—Anchylostomum duodenale.

The symptoms may simulate, and have been mistaken for, catarrh, ulcer, and cancer of the stomach, chlorosis, anæmia, pernicious anæmia, leukæmia, valvular disease of the heart, and malarial cachexia. The diagnosis rests upon the fact of multitudinous attack, by preference of the working classes, masons, and miners, without regard to age and sex, but with especial regard to a hot climate and bad drinking water. Malaria is differentiated by enlargement of the spleen and liver, melanæmia, and characteristic corpuscles in the blood; leukæmia, by affection of the spleen and lymph glands, with specific alterations in the blood. Certain cases of pernicious anæmia are cases of this disease. In doubtful cases the diagnosis is established by the detection of ova in the stools, generally intimately intermixed with the contents of the bowel on account of the high habitat of the worm. They are best disclosed by dilution of the fæces in water, and examination of the sediment which falls over night in a conical glass.

Treatment.—Thymol has proven, in the hands of Bozzolo, Graziadei, and Lutz, a specific in the treatment of this hitherto intractable disease. The treatment should be prefaced with a dose of calomel, gr. x., and the drug should be given in repeated moderate doses, ʒ i. pro die in capsule or compressed tablet, for several days. Large doses of the fluid extract of male fern, ʒ ij.–vi., if fresh and of good quality, are almost equally effective.

Trichina (*θρίξ, τριχός*, hair) spiralis (a name applied by Owen, 1835, to the immature parasite encapsulated in muscle, where it was first observed) is present in man in both the developed and

undeveloped states: developed, mature in the intestinal canal; undeveloped, immature in the muscles. The trichina also infests the hog, rat, cat, rabbit, fox, and guinea-pig. It is a pure parasite, the sole example among the entozoa, having lost all relation with the external world.

The *history* of the trichina is wholly modern. Calcified remnants of this parasite in muscle were looked upon as dissecting-room curiosities up to 1835, when Paget took a specimen to Owen, who gave it the very appropriate name it bears. Leidy, in 1846, discovered in a piece of ham upon his plate the same immature form, which was still regarded as an innocent wandering nematoid worm until 1860, when Zenker discovered it in myriads in the muscles of a patient who had died of a disease diagnosticated as typhoid fever, but marked by extreme pain in the muscles, with œdema of the surface, which symptoms he correctly attributed to the presence of the parasites. Virchow, Leuckart, and Zenker then demonstrated their migration from the intestines to the muscles; and two years

Fig. 46.

Fig. 47.

Figs. 46 and 47.—Mature trichinæ.

later, in 1862, Friedreich made the first diagnosis of the disease in life, with the detection of the parasite in a piece of exsected muscle.

Anatomy, etc.—The mature intestinal trichina is round, elongated, white, and, as its name implies, extremely filiform, on which account it is barely visible to the naked eye as a fine wool hair or silvery thread. The head, formerly regarded as the tail, is drawn out almost to a line, while the caudal extremity is somewhat rounded off and is not much thinner than the body. The alimentary canal begins with a muscular mouth, is continued into an elongated œsophagus, expanding into a flask-shaped stomach, to be again continued into the intestinal canal, which at its extremity receives in the male the opening of the seminal duct, arising from a single testicle, a thick cul-de-sac which runs along the side of the body. The female, one-eighth of an inch in length, is twice as long as the male, to accommodate the ova with which it is stuffed, and which are hatched within the body and born alive. The orifice of the vagina is situated at the junction of the first and second quarters of the body. Each female may give birth, in the course of a month, to over a thousand young. The parent trichinæ are short-lived. The

are probably, for the most part, digested and absorbed after reproduction, as they disappear from the intestine in five to eight weeks, and are, unfortunately, not often to be found in the stools.

The new-born immature trichinæ, one two-hundredth of a line in length, having escaped from the body of the parent, penetrate the intestinal wall, probably by means of chemical irritation, to migrate, chiefly along the meshes of the connective tissue, to contiguous muscles, more especially to the diaphragm, abdominal, intercostal, laryngeal, cervical, ocular, and proximal muscles of the extremities, in which latter region they are crowded, as if arrested, at the tendinous extremities. Here they continue to grow for fourteen days to a length of half a line, when they coil up to assume the well-known spiral form, disintegrating the muscular tissue, expanding and thickening the sarcolemma, and, as a result of the inflammatory process thus produced, leading to the formation of a lemon-shaped capsule one-fifth of a line in length, in which they lie for the most part singly, or more rarely in groups of two, three, or even four. Thus they remain encysted alive for a year or more, exceptionally as long as twenty-five years, or become subsequently calcified—after calcification of the containing capsule—a process which begins at the poles of the cyst, but is not of necessity fatal to its contents, even when complete.

Fig. 48.—Young trichinæ in muscle.

Muscular tissue thus infested, when taken as food (one ounce containing at times fifty to one hundred thousand parasites), is dissolved in the process of digestion, liberating from their capsules, in from three hours to three days, the muscle trichinæ, which attain sexual maturity in the intestinal canal in five days, and then reproduce their species with the rapidity described. Trichinæ have also been found in the blood, mesenteric glands, and peritoneal cavity.

Thus the Trichina spiralis, which was formerly regarded as an accidental and innocent inhabitant of the muscular tissue, has been

unmasked, since the first observation of Zenker in 1860 on a servant girl in the hospital at Dresden, as one of the most widely disseminated and deadly of all known parasites.

The *symptoms* of trichinosis, as the disease is called, vary according to the quantity ingested and the irritation produced. Small numbers produce no symptoms, calcified remnants having been often found in autopsies with a history of absence of any symptoms

FIG. 49.—Trichina encapsulated in muscle.

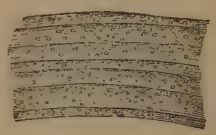


FIG. 50.—Calcified relics.

in life. A certain stage of development and capsulation is also requisite to infection. Too young or insufficiently protected trichinæ are killed in the stomach. Calcified capsules may not liberate their contents. The irritation, with the consequent rapid increase of peristalsis in childhood, often causes the expulsion of trichinæ unliberated from their capsules in the stools. The ingestion of alcohol in large quantities with the meal may destroy them as rapidly as they are liberated.

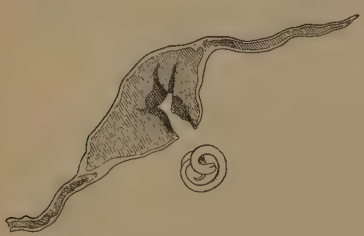


FIG. 51.—Young trichina liberated from capsule.

FIG. 52.—Encapsulated trichina.

The *stage of invasion*, which shows itself in from three hours to three days or longer, as successive quantities may be ingested, is characterized by irritation on the part of the stomach and intestines, viz., by *anorexia, nausea, vomiting, tenderness to pressure, pain in the bowels, and diarrhœa.* These symptoms may be absent altogether, or may vary greatly in intensity, to assume at times such severity as to be mistaken for cholera, as in the epidemic of Hedersleben in 1865, a city of two thousand inhabitants, where three hundred and thirty-seven persons were attacked, and one hundred and one died,

three on the sixth day. Animals fed with trichinotic flesh often succumb on the fourth day. The fever, thirst, headache, and general prostration which may accompany the local signs belong equally to other causes of intestinal irritation and are not peculiar to trichinosis.

Characteristic symptoms announce the advent of the stage of *migration* and *colonization* in the muscles, which begins as a rule on the seventh day with *œdema, functional disturbance, and pain* in the muscles. Œdema shows itself first, or is noticed first as a rule, in the eyelids, disappearing in a few days and returning later in the course of the disease. This œdema is often coincident with pain, tension, and restriction of movement in the muscles of the eyes, as evidence of early invasion of these muscles ; though the presence of œdema here as elsewhere, in the absence of muscular signs, has also been ascribed to the action of some toxic principle acting upon the vaso-motor system. Œdema of the face is often, that of the hands and feet more rarely, associated with that of the eyelids. Pronounced œdema of the skin over the affected muscles occurs even more constantly than about the face—is absent, in fact, in only ten per cent of cases. This cutaneous œdema also disappears for a few days, to return later. It is distinguished from the œdema of heart and kidney disease by its association with the muscular signs, as well as by the fact that it spares the genital organs, the scrotum and labia majora.

Muscle symptoms appear on the ninth or tenth day as a rule, delayed at times to the fourteenth, varying in every grade of intensity from lassitude, stiffness, or tension, to board-like indurations and most atrocious pains. The flexors of the extremities, the biceps and muscles of the calf especially, become swollen, tense, and tender, the extremities being held in semi-flexion to simulate the postures of acute articular rheumatism. Invasion of the diaphragm, abdominal and intercostal muscles, gives rise to dyspnœa ; invasion of the masseters, which may excite trismus, renders mastication painful or impossible ; while invasion of the tongue and pharyngeal muscles may restrict or prevent deglutition, accounting thus for the rapid emaciation. Invasion of the larynx is shown by hoarseness of voice or aphonia in twenty per cent of cases, and of the ocular muscles by fixation of the eyeball, chemosis, and occasionally by mydriasis and nystagmus. Impairment of hearing follows invasion of the stapedius muscle.

Sweating is another common symptom of trichinosis. It occurs early, always in connection with the muscular pains, and is profuse and distressing in correspondence with their severity. It is often attended with miliaria, occasionally with herpes. Pustular erup-

tions—Friedreich once found a free trichina in a pustule—acne, furunculosis, may follow the disappearing œdema of the face.

Still another quite common as well as obstinate symptom is *insomnia*, which often rapidly exhausts the patient. With this exception the nervous system shows no symptoms. Though most cases are characterized by apathy or depression, the brain remains clear, except in the last stages of the severe attacks, when somnolence, stupor, or delirium may for a short time precede the end.

Fever does not belong of necessity to trichinosis. Average cases show slight elevations of temperature, up to 104° F. in the severe forms, which at times present the course of remittent, or more frequently of typhoid, curves. Bronchitis, even catarrhal pneumonia, may result from the impeded respiration, while extensive, even fatal hypostatic pneumonia from prolonged decubitus is not uncommon in protracted cases.

Duration.—The disease lasts from two weeks in the lightest cases to eight weeks in pronounced cases, and with sequelæ, for the greater part of a year, in the severest forms. Kunze heard complaints of rheumatic pains in bad weather four years after the Hedersleben epidemic, and Kratz found weakness of the muscles in one case eight years after the attack. The mortality ranges from one to seventy, averaging thirty per cent. Death occurs usually from exhaustion or blood poisoning in from four to six weeks, exceptionally earlier from gastro-intestinal irritation, and later from hypostatic pneumonia and marasmus.

Fig. 53.—Trichina in muscle.

The *prognosis* depends largely upon the number ingested and the lapse of time. Children almost never succumb, because most of the trichinæ are ejected by diarrhœa. Patients who survive the eighth week recover. Severe myositis or dyspnœa, profound prostration and nervous symptoms, aggravate the prognosis. Recovery is, as a rule, much more tedious and protracted than after other acute infections of corresponding severity.

The *diagnosis* is illuminated often by the fact that others are simultaneously affected, or by the inspection of suspected pork; possibly by the detection of mature or encapsulated trichinæ, more especially after a brisk cathartic, in the mucous but not in the fluid contents of the voided stools; positively by the discovery of immature trichinæ in the muscles, extracted preferably after linear incision under antisepsis, from the deltoid or lower part of the biceps muscles—for the most part an unnecessary procedure. A history of gastro-intestinal irritation, followed by constipation, œdema of the

face on the eighth day, and muscle signs by the tenth day, with sweating, insomnia, headache, thirst, and fever, sufficiently characterizes the disease.

Articular rheumatism, which has pain and sweating in common with trichinosis, is distinguished by the affection of the joints proper, more especially of the smaller joints, by the absence of gastro-intestinal irritation, dyspnœa, insomnia, and affection of the muscles of the jaws and eyes.

Muscular rheumatism selects by preference other muscles than those affected in trichinosis, and is unattended with gastro-intestinal irritation, œdema, fever, and sweats. Grawitz, Virchow's assistant, declares that trichinæ were found, on autopsy, in one-third of the cases of so-called muscular rheumatism.

Typhoid fever is differentiated by the mental disturbance, a characteristic temperature curve, diarrhœa generally throughout the disease, meteorism, and is not attended with œdema, asthma, and muscular signs.

Meningitis shows herpes as a rule, hyperæsthesia, opisthotonos, a contracted abdomen, and has a different history. Finally, polymyositis, which shows pain in the muscles, tension, deformity, prostration, œdema, sweats, and insomnia—in short, most of the signs of trichinosis—is distinguished by isolated attack, by the absence of history and gastro-intestinal signs, preference of the extensor muscles, and exemption of the diaphragm, larynx, tongue, and pharynx. Excised portions of muscle show hyaline or waxy degeneration, but no trichinæ.

Prophylaxis.—Naked-eye inspection of meat does not disclose the Trichina spiralis except in cases of calcification, and calcification is not necessarily fatal to the trichinæ. Putrefaction does not destroy them. Copious libations of alcohol with meals is a preventive as unreliable as unadvisable. Smoking and pickling, as ordinarily practised, kill only the surface trichinæ. A temperature of 160° F. is fatal to the trichina, so that thorough cooking of meat offers a sure prevention of infection. A long subjection to high temperature is requisite to secure penetration to the interior of a large mass of meat of the necessary grade of heat.

Therapy.—Successful therapy depends upon an early diagnosis, which is often unattainable. A brisk cathartic, calomel gr. x.–xx., castor-oil ℥ i., or infusion of senna, followed by irrigation of the colon, offers a hope of discharging many of the worms before they have been liberated from their capsules; and inasmuch as Kratz and Cohnheim found trichinæ in the stools as late as the twelfth week, it may be said that it is never too early or too late, for purposes either of diagnosis or of therapy, to give this method trial.

Recently liberated trichinæ may be benumbed and more readily discharged by the administration of thymol, 3 i.–iss., divided in two or three doses ; or extract of male fern, 3 i.–iv. After colonization in the muscles the treatment becomes purely symptomatic. The hope of radical extermination by rapidly diffusible agents, picric acid and benzin, or water-extracting agents, glycerin and alcohol, has proven illusory. Applications of hot water, salicylic acid gr. vij., salol gr. x., more especially phenacetin gr. x., or antipyrin gr. v., every hour, may be tried in relief of pain not so great as to indicate morphine, which becomes a necessity in severer cases. Sodium bromide gr. xl., antipyrin gr. x., chloral gr. xv., may suffice to secure sleep, which is, however, in bad cases forced only by morphine. As the safety of the patient depends upon speedy encystment of the trichinæ—a process which is hindered by motion of every kind—repose and quiet as absolute as possible should be enjoined and secured. The strength is to be sustained by alcohol and food until the force of the disease is spent.

Fig. 54.—Guinea worm.

Filaria Medinensis (Guinea worm).—Found frequently in Asia and Africa. A very long—sixty to one hundred centimetres—slender worm with rounded head and hooked tail ; female only known as yet, which finds some median host in minute crustacea, with which, in drinking water, the embryo gets entrance into the body of man. It is carried by the blood vessels to the periphery, where it develops to maturity, forming furuncles and abscesses in the subcutaneous tissue, most frequently in the lower extremity near the heel. In this process it may develop gangrene or general rigors, fever, convulsions, etc. Care must be taken in its extraction not to break it off, as it may protrude from an open wound in the skin. To avoid this accident it should be gently wound around a stick and very slowly withdrawn in the course, if necessary, of several hours.

Filaria Sanguinis.—A dangerous nematoid worm found in the body is the Filaria sanguinis, first described by Bancroft, hence Filaria Bancrofti, and first recognized as a cause of chyluria by Wucherer, of Bahia (1869).

The Filaria sanguinis, like the Trichina spiralis, is found in both mature and immature states in the body of man. The mature form

lives viviparous in the lymph vessels of the scrotum and the lower extremities, and is a parasite of the respectable length of eight to ten centimetres. The young filariæ find their way from the lymph vessels to the blood, where they are encountered in great numbers, each worm measuring 0.35 mm. in length, with a breadth about the diameter of a red blood corpuscle. A protruding sheath often envelops one end of it. The worm shows active sinuous motion. Manson made the curious discovery that the filariæ of the blood are to be seen only at night, whence the failure which has marked many attempts at their discovery during the day. Fluids must also be examined fresh. Some intermediate stage of development must exist between the mature filaria in the lymph vessels and the immature filaria in the blood, outside the body, else various transition forms would be seen. There is reason to believe that the animal or insect which officiates in securing this transition state is the mosquito. The mosquito sucks itself full of blood containing the filaria and carries it to water, whence the mosquito arises, so that the body of man becomes the host of the work through the medium of drinking water.

Fig. 55.—Filaria sanguinis.

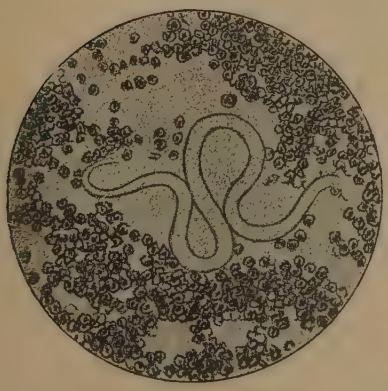


Fig. 56.—Filariæ in blood vessels.

Fig. 57.—Elephantiasis cruris lymphangiectatica (Ziegler).

The Filaria sanguinis is a dangerous parasite, in that it produces symptoms in both stages of development. In the skin it causes

sclerosis, elephantiasis, occlusions of the lymph vessels, lymphangitis, lymphangiectasis, and ruptures. In the blood and lymph vessels it may lead to occlusions, dilatations, and ruptures, with escape of lymph, sometimes of blood.

The curious condition known as chyluria, from rupture of lymph vessels into the bladder or renal pelvis, is found to depend in many cases upon the Filaria sanguinis. The urine in these cases looks like milk, and may contain as much as three per cent of fat. Hæmaturia also, but more infrequently, arises from the same cause.

Prophylaxis is simple. It consists in thorough boiling of all drinking water, from whatever source. Perfect filtration would be equally effective.

No known remedy may reach this parasite in the tissues or in the blood. It has been suggested that the picro-nitrate of potash, on account of its highly diffusible properties, might be of benefit. Treatment is really wholly symptomatic. The tincture of iron is indicated, gtt. xxx. ter in die. Lewis recommended gallic acid.

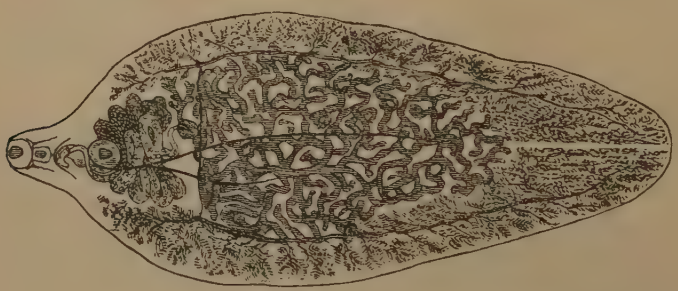


Fig. 58.—Liver fluke.

Liver Fluke.—Of the trematoid (*τρῆμα*, foramen) worms, the only example of particular interest to the practitioner of medicine is the *Distoma* (double mouth) *hepaticum*, or liver fluke. The liver fluke is, as the name implies, a flat, somewhat triangular worm about an inch long and half an inch wide. The somewhat elongated head terminates, or begins, in an oval sucker, below which on the ventral aspect is another sucker, which orifices have given the worm its place. Between the two suckers is the genital orifice. The yellowish, oval eggs are among the largest found in the fæces.

The liver fluke is encountered rarely in man, more frequently in the ox, deer, occasionally in the horse and hog, by far most frequently of all in the sheep, where it causes the disease commonly known as the rot, which kills annually thousands of sheep.

The development of the liver fluke is a strange story. The eggs escape with the bile into the intestine, whence they eventually reach

water, and, being provided with a ciliated envelope, swim about freely until they come in contact with the body of a snail, which they penetrate to become lodged in its interior. Here the embryo, losing its ciliated envelope, becomes converted into a cyst, which produces on its interior elongated bodies called nurses. The nurses penetrate to the liver of the snail, where are developed new forms somewhat of the shape of the parent fluke, called cercarias. The cercarias escape from the nurse and the body of the snail into the water, and, being provided with a long tail like a tadpole, swim about actively for a time until they become attached to subaqueous grasses, when they lose the tail and become quiescent. Thence, in the grazing of sheep, they may be reconveyed to their bodies to find a way to the liver and develop to sexual maturity.

Fig. 59.—Distoma hæmatobium with ova. Male in gynæcophoric canal of female.

The liver fluke is rarely found in the body of man in such numbers as to cause occlusion, dilatation of the bile ducts, and reabsorption of the bile, with the serious complications which result from this condition. The paucity of their number in man protects him against disastrous consequences. Prevention is the avoidance of subaqueous vegetables, such as watercresses, to which the bodies of snails are attached, and of impure drinking water.

The Distoma Hæmatobium is found in the portal vein, in its trunk and derivative branches, in the body of men and apes. The ova, deposited in the mucosa of the ureters, bladder, etc., develop embryos which produce ulceration in these structures. This parasite is frequent in Egypt and Abyssinia, but has not been seen elsewhere.

CHAPTER III.

BACTERIA.

The term bacteria (*βάκτρον*, a rod) applies collectively to a large class of micro-organisms, the study of which is known as bacteriology. These bodies constitute the simplest and lowest forms of all living things. From their mode of propagation—by fission—they fall in botanical classification under the division of schizomycetes (*σχίζειν*, to split). Bacteria are collections of protoplasm made up of an albuminose body, microprotein, fat, salts, and water. They have no chlorophyll, and may not, therefore, appropriate for their nutrition carbonic acid. Hence they must live as parasites on preformed combinations, but the smallest traces of nutritious matter—that which may be found, for instance, in the purest distilled water—may abundantly suffice for their nutrition. They flourish best, as a rule, on feebly alkaline soils. With all other forms of life, they originate only from themselves, and never by spontaneous generation.

The body of the bacterium consists of the protoplasm (mostly colorless), enclosed in a delicate but resistant membrane, like cellulose, insoluble in acids and alkalies. This membrane may, under certain circumstances, swell to form a sheath or capsule, or exude a mucoid-like substance in which masses of bacteria may be agglomerated to constitute the so-called zoöglœa. Such zoöglœa, in masses or lines, show definite shapes in definite soils, and furnish distinguishing characteristics.

Bacteria are divided, from their shape, into micrococci, bacilli, and spirilla—*i.e.*, spherules and cylinders, straight or curved.

Micrococci occur alone as monococci, in pairs as diplococci, in fours in a single plane as merista, and in eights as sarcinæ, which multiply in the three dimensions of space, to appear like dice. Micrococci multiplying in a line are known as streptococci (*στρεπτός*, a chain); multiplying in a mass, as staphylococci (*σταφυλή*, a bunch of grapes). A coccus or bacterium whose length is greater than its diameter—*i.e.*, an oval micrococcus—is a bacillus. Spirilla are curved bacteria—with one curve, like a comma, the vibrio; or with

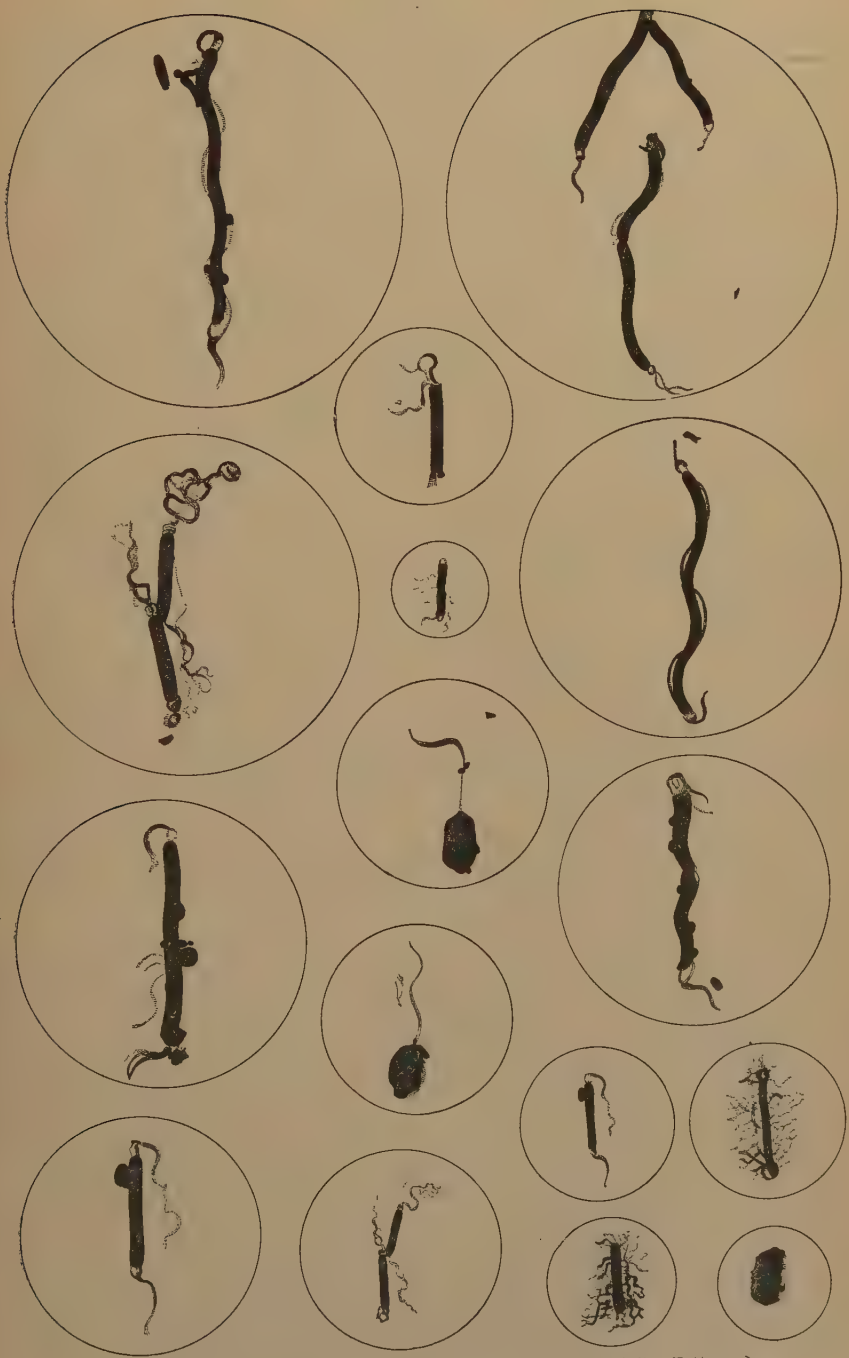


FIG. 60.—Bacilli stained to show vibratile cilia and flagella (after Zettnow)

successive curves, like a corkscrew, the spirochæte. Bacteria vary greatly in both length and breadth, but are, for the most part, so small as to be on the confines of the visible, even with the microscope.

The mass of micro-organisms are innocent to man. The bacteria

Fig. 61.—Streptococcus.

Fig. 62.—Spirochætes of relapsing fever.

of putrefaction return to earth and air everything that has ceased to live, so that life would soon become impossible without them. It is only under certain circumstances that the bacteria of putrefaction may prove injurious. Innocent micro-organisms injected into the body, even in mass, do no harm. They fail to find necessary conditions for development, and perish.

Fig. 63.—Sarcinæ.

Fig. 64.—Yeast plant.

Fig. 65.—Bacillus pneumoniæ (Friedländer) with gelatinous envelope.

Pathogenic micro-organisms vary in length from one to forty (1–40 μ) micromillimetres, and in breadth from 0.5 to 7 μ.[1] Many micrococci are too minute to admit of accurate measurement. The largest micro-organism is the spirillum, which may reach a length of

[1] An μ (mikron) = $\frac{1}{1000}$ millimetre.

0.2 of a millimetre. Perhaps a better idea of size can be conveyed by comparison with a similar object. The bacillus tuberculosis, which occupies in respect to size a median place, varies in length from $\frac{1}{1200}$ to $\frac{1}{3500}$ of an inch, the smaller measurement being the average diameter of a corpuscle of human blood. Many species are endowed with motion, gyration, sometimes with address and agility, rotation and oscillation, flexion, extension, and locomotion. The bacilli of tuberculosis and milzbrand, together with all micrococci, have no motion at any time. That tremulous, molecular motion—the so-called Brown's motion—in the same place, observed also in inorganic matter, is to be distinguished, of course, from individual motion. Motion is often secured to micro-organisms by means of vibratile cilia, though most bacteriologists believe it to be a property innate or inherent to the protoplasm.

Bacteria multiply by division (fission)—that is, by increase in size and separation into two (the cholera vibrio splits in two in fifteen to forty minutes)—or by the formation of spores, spherical bodies which elongate to form bacteria. Micrococci multiply only by division, and spores have not yet been distinctly demonstrated in spirilla. Bacilli form spores in two ways: by development in their interior, with subsequent liberation on rupture of the bacillus—endospores; or by development at an extremity, which falls away to constitute a new individual—arthrospores (ἄρθρον, a joint). Endospores are much more tenacious of life than the bacillus, or than the arthrospore, which is endowed with no particular resistance. Hence endospores constitute what are known as permanent forms. In either case the protoplasm of the bacillus clears up at the point of formation of the spore, to assume the shape of a minute drop of greater diameter, at times, than the bacterium itself. Bacilli filled with spores, which may exist to the number of three or four, show a checkered or beaded surface. The activity of formation of spores is an index to the degree of nutrition. The liberated spore soon breaks the spherical surface with a point, which gradually elongates to form, in turn, the perfect bacillus. Spores may be recognized by their glistening, highly refracting contour.

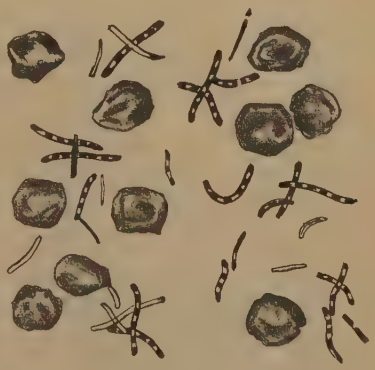


Fig. 66. — Bacilli tuberculosis, showing spores.

According to the mode of nutrition bacteria are divided into saprophytes (σαπρός, rotten), which live on dead soils, and parasites

(παράσιτος, feeding with or on), which live on living matter. Parasites are also divided into obligates—that is, pure parasites—and facultatives, which may live both as parasites and saprophytes.

Bacteria are again divided, according as they may live with or without oxygen, into aërobes and anaërobes. Here, too, there are obligate aërobes, which can live only in the presence of oxygen, and obligate anaërobes, which can live only in the absence of oxygen. And here, too, there are facultative anaërobes, which may live in the presence of oxygen.

Saprophytes thrive best at a temperature of 20° to 25° C., parasites best at 35° to 40° C. Every micro-organism has its own peculiarities regarding temperature. Sunlight destroys all micro-organisms ; even the most tenacious spores or permanent forms perish under the direct rays of the sun in the course of a few days.

Bacteria are invisible not only because of their size, but also because of their lack of color, and are rendered visible by various stains or dyes. For this purpose the best materials are the acid and basic aniline dyes, especially methylene blue and violet, gentian violet, Bismarck brown, fuchsin, and, of the acid anilines, eosin and acid fuchsin. They are usually prepared as follows :

Alkaline methylene blue solution (Löffler) : Concentrated alcoholic methylene blue solution, thirty cubic centimetres ; liquor potassæ (1 : 10), one hundred cubic centimetres.

Aqueous aniline dyes (Ehrlich) : Aniline oil, four cubic centimetres, thoroughly agitated with water, one hundred cubic centimetres, filtered after deposit ; whereupon is added concentrated alcoholic solution of fuchsin or methylene violet up to distinct opalescence.

Carbolic-acid-fuchsin (Ziehl-Neelsen) : Distilled water, one hundred ; crystallized carbolic acid, five ; alcohol, ten ; fuchsin, one.

Iodine-potassium-iodide solution : Iodine, one gramme ; potassium iodide, two grammes ; distilled water, three hundred grammes. For use the solution is diluted to a Madeira color.

The most generally employed is the carbol-fuchsin solution. The various micrococci, staphylococci, streptococci, Fränkel's diplococci, cholera vibrios, recurrent fever spirilla, and nearly all the pathogenic micro-organisms of man, as well as most of the saprophytic bacteria, are quickly and distinctly stained in this way. A large drop of this solution, let fall upon the object glass from a pipette and heated a few seconds to half a minute, suffices to color all bacteria distinctly. A few forms with dense membranes must be heated a whole minute.

Bacteria are prepared for color, if in water or bouillon free of fat, by simply washing in water ; but, if in an albuminose fluid (blood, pus, or œdematous fluid of pneumonia) the cover glass should be dipped in absolute alcohol ; if in fat (milk or œdema of connective

tissue), the cover glass, after drying and before heating, should be placed a short time in absolute alcohol and ether. In this way are colored not only the bacteria but also all protoplasm in the field.

A valuable solution, especially in differential diagnosis, is that of Gram, which is prepared as follows: To ten parts of aniline water (*i.e.*, the milky fluid which results from the agitation of four parts of aniline oil with one hundred parts distilled water) is added one part concentrated alcoholic gentian violet solution. The mixture is then passed through a filter moistened with water. The object glass, after drying and heating, is floated upon this stain five to fifteen minutes, sometimes under heat, and is then, without washing, exposed at least five minutes to the iodine-potassium-iodide solution. The blue-black color thus imparted is decolorized in first weak, then stronger, but not absolute, alcohol to a pale gray or yellow. Hereupon the specimen is dried in the air and examined under the oil of cedar or conserved in balsam. By the method of Gram all cell elements are decolorized, while the bacteria maintain their dark-blue stain. Thus are colored the pneumococcus of Fränkel, the streptococcus of erysipelas and acute suppuration, the staphylococcus of pus, the bacilli of anthrax, the mycelia of actinomyces, and the bacilli of tuberculosis. But the method of Gram will not color Friedländer's pneumonia bacillus, the typhus bacillus, the gonococcus, or the cholera vibrio.

As they are but indistinctly colored in this way, tubercle bacilli require special treatment. A particle of sputum compressed between two coloring glasses is spread out by the separation of the glasses. The specimen is then dried by the passage of the glass, held with forceps, about as fast as cutting bread, three times through a flame, specimen side up. The cover glasses are then dropped upon the aniline water solution with fuchsin or gentian violet, or heated in this solution until vapor arises, then decolorized in a solution of nitric acid (1:4) and alcohol (sixty per cent). An aqueous solution of methylene blue or Bismarck brown furnishes the after-stain; or, by a shorter method, the cover glasses or sections are colored in carbol-fuchsin, and then brought for one minute into a solution of water fifty, alcohol thirty, nitric acid twenty.

Spores may not be colored after these methods, as their firm envelopes prevent penetration. This resistance is overcome by subjection to heated steam for an hour, or by passage seven to ten times through a flame.

Bacteria are isolated and are further and much more positively distinguished by cultivation in certain soils. The first experiments in cultivating bacteria were made in fluids, solutions of meat, beef tea, chicken soup, malt extracts, infusion of hay, etc.; but fluids are open

to the objection that they admit other germs to coalesce with, and render impure, the special variety to be studied. Pure cultivations became possible only with the use of the solid culture soil first employed by Koch. Germs falling upon a solid surface remain

Fig. 67.—Bacillus Havaniensis (Sternberg).

Fig. 68.—Scale surface culture (serum) of tubercle bacillus.

Fig. 69.—Nail stick culture (gelatin) of pneumococcus.

fixed in the same place. The solid culture soil made practicable the absolute isolation of germs, without which accurate investigation is impossible. Koch made his first studies with the common potato. The potato was the key to the whole subject of solid cultures. What the apple was to Newton the potato was to Koch. Subsequently gelatin was employed,

then aqueous humor, then gelatinized meat preparations, peptonized gelatins, etc., and, as a climax, gelatinized blood. Thus has been determined the peculiar soil in which the varieties of pathogenic bacteria thrive best. Moreover, it is seen that the colonies in their growth assume different forms or shapes, or exercise different effects upon the soil. Different bacteria vary also in the degree in which they fluidify the semi-solid substance of their soil.

Lastly, pathogenic bacteria are distinguished by their physiological effects. From any special successive generation of a special variety of bacteria, material may be selected for introduction into the body or blood of various animals. Bacteria, or their products in culture soils, are introduced into animals by ingestion with food or by means of the œsophageal sound; by inhalation or insufflation of atomized matter; by intraperitoneal, intraocular, or intravenous injection, as into the external jugular or (in rabbits) posterior auricular veins; lastly, by subcutaneous injection with the disinfected syringe, or by subcutaneous insertion with the platinum needle, usually into slight wounds of the skin, under thorough asepsis.

Pathogenic micro-organisms act in two ways: by *intoxication* and by *infection*. Intoxication is a poisoning by products of micro-organisms produced outside of the body; infection is poisoning by products produced by bacteria inside the body. These sources are sometimes distinguished as ectogenic and endogenic—terms destined soon to substitute miasmatic and contagious as applied to infectious disease. Intoxication is caused by the saprophytes, which may produce ferments in food, as in meat, fish, sausage, milk, and cheese. The ferments may be infective even after destruction of the micro-organisms which caused them; so food, even though cooked, may produce disease. The causes of infection are the pathogenic micro-organisms which multiply inside the body and evolve chemical products. The fact that pathogenic micro-organisms are not absorbed proves that they produce disease by some chemical change. Moreover, the character of the symptoms—sopor, stupor, coma, delirium—which supervene in cases of grave acute infection speaks in favor of this view and against the belief that bacteria act mechanically or by the mere abstraction of oxygen. The only hitherto known poisons which may, in minute quantities, induce such grave toxic signs are the poisons resulting from the action of the bacteria of decomposition upon organic matter. As these intensely virulent poisons were first observed only in dead organic matter, they were called ptomaines (*πτωμα*, the fallen, a corpse; hence more properly ptomatines). As many ptomaines are perfectly innocent, the term has been better substituted by Toxines. The toxines are nitrogenous, basic compounds, like the vegetable alkaloids, of complex com-

position. Among the non-poisonous ptomaines there have been extracted, in all cases from decomposing dead bodies, neuridin, cadaverin, putrescin, and cholin. Poisonous—*i.e.*, toxines—are: peptotoxin, present in many peptones; neurin, in decomposing meat; muscarin, the poison of the fly fungus, found also in decomposing fish. From pure cultures of pathogenic bacteria have been extracted a toxine from the typhoid bacillus—typhotoxine; from cultures of the tetanus bacillus and the amputated extremity of a man dead of tetanus, tetanin and tetanotoxin. Besides the ptomaines or toxines there are to be found certain albuminoid bodies, products of micro-organisms, with similar poisonous but very different chemical properties, which are known as toxalbumins. Such toxalbumins have been separated from cultures of the diphtheria, typhoid, and tetanus bacillus.

Animals, including man, vary in susceptibility to the action of micro-organisms and toxines. Certain animals are more, certain animals are less, liable or susceptible to contract or be inoculated with a disease. These animals are said to be, one predisposed to, the other endowed with, immunity to these diseases.

The *disposition* to a disease may be natural—*i.e.*, inherent—or acquired.

Natural immunity may be overcome in various ways. Starvation makes pigeons susceptible to anthrax. The injection of papayotin leads to the appearance of hitherto latent micro-organisms to such degree, according to Ribbert, that the heart's blood will be thick with them in two hours; that is, the introduction of a vegetable ferment so profoundly alters the condition of the blood as to make of a hitherto sterile a fertile soil. So, also, certain ptomaines will reduce all energy to such an extent that bacteria hitherto innocuous become infectious. According to Rogers, the immunity of rabbits to rauschbrand is overcome by the introduction of the innocent Bacillus prodigiosus. Guinea-pigs immune to chicken cholera are rendered susceptible by the injection of hydracetin or pyrogallol, substances which dissolve red blood corpuscles; and the addition of phloridzin, which causes a toxic diabetes, discharges the immunity of white mice to glanders.

Hunger makes pigeons, naturally immune, susceptible to milzbrand. Fatigue acts in the same way with other animals. Thus white rats made to walk a wheel continuously for seven days lose their immunity. Temperature plays a similar rôle. Frogs kept at a temperature below 28° C. will not contract the disease, but will inevitably succumb to it at higher grades. Hydræmia lessens the susceptibility of rabbits to the staphylococcus by eliminating toxines through the kidney. Here is a hint regarding the value of free libations of water in the treatment of typhoid fever and other infec-

tions of man. Staphylococci injected into the peritoneal sac are resorbed without damage, unless the peritoneal endothelium be injured or diseased. Lipari found that the intratracheal injection of the sputum of pneumonia did no damage unless the animals were exposed to cold, which probably acted by producing catarrhal swelling and paralyzing ciliary motion, to permit the retention of bacteria. The so-called "mixed infection" occurs in this connection. Tuberculosis admits the organisms of sepsis, as does also diphtheria. The organisms of measles and pertussis prepare the soil for tuberculosis, etc.

The problem of medicine in the prevention and cure of disease is the reverse of this process, to wit, to confer immunity in lieu of liability.

Artificial immunity is conferred in various ways : 1. By increasing cell energy to resist the invasion of disease. Phagocytosis is an exemplification of this process. Healthy cells incorporate, digest,

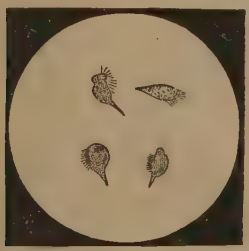


FIG. 70.—Trichomonas intestinalis.

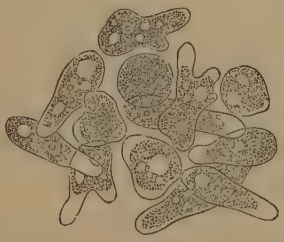


FIG. 71.—Naked amœbæ coli.

FIG. 72.—Cercomonas intestinalis.

and destroy micro-organisms ; feebler cells yield before them. 2. By previous attack of a disease, as in inoculation of variola. 3. By inoculation of a milder form of the disease with attenuated micro-organisms or matter, as in the case of vaccinia and hydrophobia. 4. By inoculation of substances extracted from the blood (serum) of animals which enjoy natural immunity, or to which immunity has been conferred. These principles may be also extracted from the milk (Ehrlich). 5. By inoculation of matters extracted from culture soils in which specific micro-organisms have been developed.

Substances extracted in this way from the blood, milk, or from culture soils are known as *antitoxines*. Such antitoxines have been already found in tuberculosis (tuberculin), pneumonia, diphtheria, glanders, hydrophobia, tetanus, and typhoid fever. Future specific therapy lies in the direction of the discovery and perfection of antitoxines.

PROTOZOA are the very lowest forms of animal life. They are minute masses of protoplasm of various shape ; sometimes naked, gene-

rally invested with a membrane; sometimes enclosing pigment matter and vacuoles, and sometimes ciliated, flagellated, etc. How protozoa find entrance into the body of man is as yet unknown, but they are certainly encountered in the blood, in various juices, or-

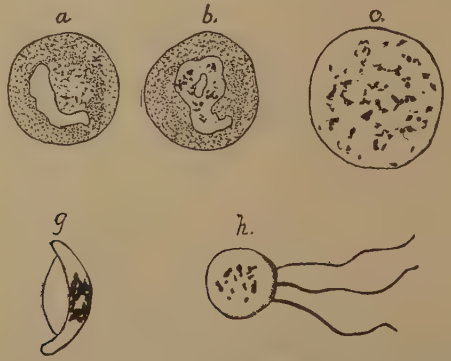


FIG. 73.—Plasmodium malariæ: *a*, *b*, *c*, intracorpuscular bodies; *g*, crescent; *h*, flagella.

gans, and tissues of the body, epithelium, and, in some cases, definitely in connection with certain diseases.

Protozoa are divided, according to their modes of motion, nutrition, etc., into three groups—the rhizopods, sporozoa, and infusoria. Rhizopods are, for the most part, naked—*i.e.*, membraneless—masses of protoplasm, with digital or filiform protrusions (pseudopods) to surround and incorporate food or foreign bodies, as in the amœbæ, which belong to this group.

FIG. 74.—Coccidia from the human liver: A × 330, B and C × 1,000 (Leuckart).

Infusoria possess permanent cilia, by which they secure motion and ingest food into an oval orifice. Both infusoria and rhizopods live on solid or semi-solid food. Sporozoa are covered by a cuticle having neither pseudopodia nor cilia, and are nourished wholly by osmosis. Sporozoa multiply by hard-shelled spores produced in the interior of the body.

Perhaps the best-studied example of disease produced by protozoa is malaria. Blood withdrawn from any part of the body, especially from the spleen, but most conveniently and safely from the end of the finger, shows in this disease such masses of protoplasm, sometimes granular, sometimes crescentic, very often irregular, as to enable the practitioner in a doubtful case to declare the existence of the disease and differentiate it from simulating maladies. As these

bodies are to be found in all cases of malaria, and not in any other disease, increasing during fever, disappearing after the administration of quinine or other antiperiodic, and as the inoculation of blood containing them conveys the disease, they are regarded as the specific cause of malaria, notwithstanding the fact that they have not yet been cultivated outside of the body. Protozoa belonging to the group coccidia have been recognized by Nisser in the nodules of molluscum contagiosum, a disease of the skin. The failure to

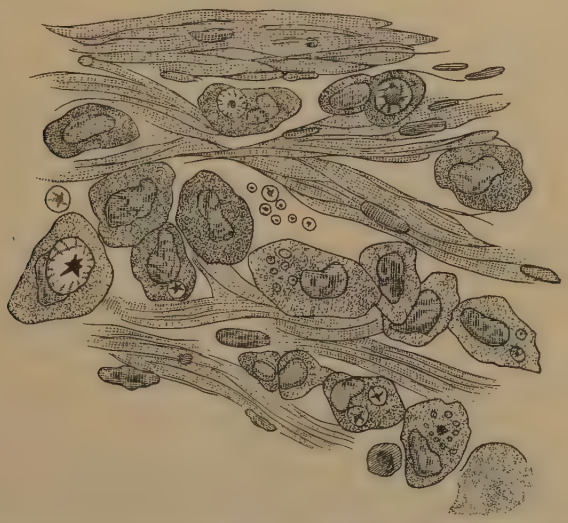


FIG. 75.—Scirrhus of the breast: epithelium enclosing protozoa, black stellate bodies, large and small (Foa).

discover micro-organisms of other nature, and the recognition of protozoa in these affections, have awakened the suspicion that certain exanthemata, also dysentery, abscess of the liver, cancer, etc., may depend upon, or be associated with, this cause.

Pfeiffer depicts sporules found in the interior of the vesicles of herpes zoster, which is now regarded as an infection, also similar structures in varicella and variola vera; and Van der Loof finds cell forms—plasmodia—in the vesicles of vaccinia.

CHAPTER IV.

INFECTIOUS DISEASES.

Up to the present time it is definitely known that micrococci produce pyæmia, septicæmia, furunculosis, acne, erysipelas, gonorrhœa, trachoma, pneumonia; bacilli cause anthrax, diphtheria including croup, typhoid fever, tetanus, tuberculosis, lepra, glanders, measles, and typhus fever; spirilla produce cholera and relapsing fever; sporozoa cause malaria.

Regarding other infections the evidence is not so positive; in some cases it is probable, in others as yet only presumptive.

SEPTICÆMIA, PYÆMIA, SEPTICO-PYÆMIA.

Septicæmia (σηπτός, poisonous); Pyæmia; Septico-pyæmia.—Infection (intoxication) of the blood and body by ferments, toxines, products of the various pus-producing micro-organisms, characterized by chills, high fever, profuse sweats, joint affections, metastatic deposits, hæmorrhages, diarrhœa, and nervous symptoms.

These affections, which were formerly considered separate, are now known to be due to the same cause and belong properly together. Predominance of general signs of blood poisoning—*i.e.*, nervous signs, high fever, etc.—in the absence of metastatic deposits, constitutes septicæmia; predominance of metastatic processes, hæmorrhage, abscesses, etc., constitutes pyæmia; conjunction of the two sets of signs constitutes septico-pyæmia.

Numerous micro-organisms produce pus and act as causes of this condition. 1. One of the most frequent is the Staphylococcus pyogenes aureus, which, cultivated on gelatin or agar, shows, after exposure to light, gold-yellow colonies. Smaller numbers localized produce in the skin acne, furunculosis, and subcutaneous abscesses; in the interior of the body, suppurations of bones and joints, of the lungs, pleura, liver, heart (endocarditis), and kidneys. The staphylococcus abounds in the air of crowded rooms. 2. The Staphylococcus pyogenes albus, which forms white colonies. 3. The Staphylococcus pyogenes citreus, which forms lemon-yellow colonies. 4. The Micrococcus pyogenes tenuis, which forms perfectly clear colonies. 5. The Strep-

tococcus pyogenes, which grows in chains of four, ten, or more members. The streptococcus has a much greater tendency to spread and to give rise to extensive phlegmonous processes.

The various micro-organisms or their products, sometimes both,

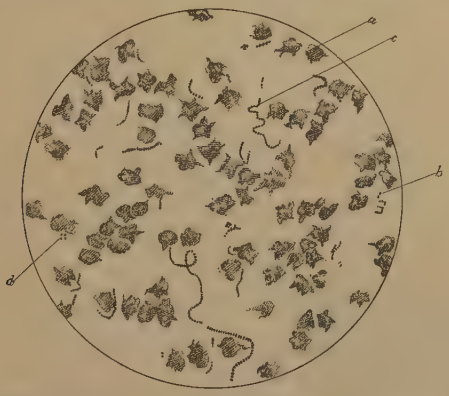


FIG. 76.—Pus from an acute abscess: *a*, pus corpuscles; *b*, diplococcus; *c*, streptococci; *d*, set of four, tetrads (Woodhead and Hare).

are introduced through breaks of the surface, wounds (parturient or puerperal uterus, etc.), or upon the heels of other micro-organisms in

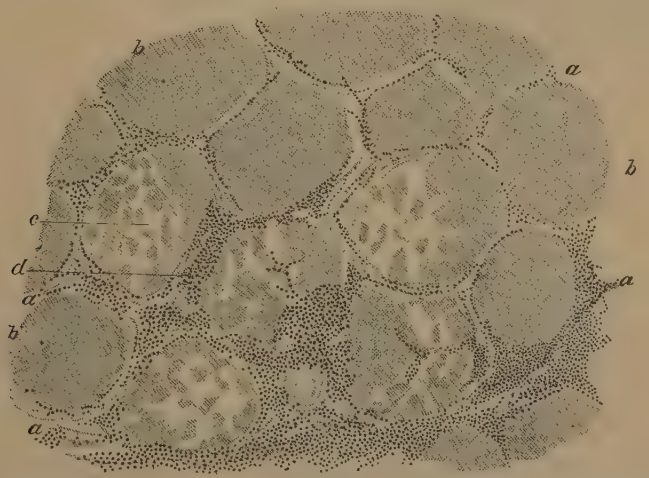


FIG. 77.—Septic infection of pectoral muscle after a "post-mortem" wound of the hand: *a*, perimysium with streptococci; *b*, cross section of unaffected muscle fibre; *c*, cross section of affected fibre; *d*, fibre penetrated by streptococci.

the course of specific disease, tuberculosis, variola, dysentery, to cause a mixed infection or constitute the terminal link in the chain of disease process.

Sometimes the avenue of entrance may not be seen or discovered. Poisonous matter may be introduced from the lungs, intestine, or other recess, to give rise, in light cases, to the symptoms of a "bad cold," dyspepsia, or rheumatism, or in bad cases to a pleuritis, ulcerative endocarditis, etc. A searching investigation will sometimes discover the source of such infection at the prostatic urethra, ileo-cæcal valve, interior or adnexa of the uterus (salpingitis), etc. Certain cases defy detection. These cases of concealed origin are very appropriately called cryptogenetic sepsis—a term much more conducive to inquiry than "idiopathic" or "spontaneous," which rest upon entirely false conceptions.

Symptoms.—The disease, considered as a septico-pyæmia, is ushered in *suddenly* in the course of puerperium, after a traumatism, operation, or *in the midst of apparent health*, with a chill or series of chills, followed by *high fever, headache, vertigo*, perhaps vomiting, and usually with well-marked nervous depression. The patient soon complains of *pain in the region of the joints*, which are sometimes swollen and tender. The spleen swells early. Sometimes there is icterus in light form from duodenal catarrh, in rarer (hematogenic) form from dissolutio sanguinis. The fever is continuous, subject to remissions, usually with evening exacerbation, with no distinct periodicity, but with periods of great elevation (106° F.) followed by profuse sweats. The surface is cold and clammy. The hectic and night sweats of tuberculosis are really septic. The pulse is enormously quickened, is soon irregular and reduced in force. The patient falls into a typhoid state, with low, muttering delirium. Metastatic affection shows itself—in the skin as scarlatiniform rashes, herpes, pustules, pemphigus, petechiæ, or larger hæmorrhage, abscesses; in the eyes as hæmorrhage of the retina, irido-choroiditis, panophthalmia; in the heart in irregular action, bruits mostly mitral, friction sounds of pericarditis, dyspnœa; in the kidneys as albuminuria, hæmaturia, casts; in the brain as embolic deposits, abscess, and hæmorrhage.

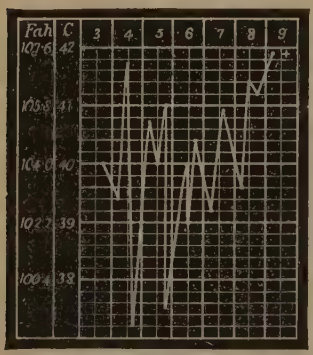


FIG. 78.—Temperature in a fatal case of sepsis.

Diagnosis.—The disease must be differentiated from: 1. Typhoid fever, which has in common with it fever, diarrhœa, spleen tumor, and petechiæ. Typhoid fever begins more slowly, is attended with mental dulness from the start; the fever is more typical. Herpes, joint affections, mitral lesions, retinal hæmorrhage, do not belong to

typhoid fever. 2. Miliary tuberculosis, in which may be often discovered a local depot of tuberculosis in the lungs, lymph glands, spine, hip, etc. Meningeal tuberculosis is usually preceded by evidence of local infection in the way of bronchial and intestinal catarrh. 3. From rheumatism, which has in common sweats and affection of the joints, but which has not successive chills, metastatic abscesses, affections of the skin, eye complication, etc. 4. Cerebro-spinal meningitis also occurs suddenly, but prefers winter, soldiers, children, and shows with no, or much less, or more irregular fever, hyperæsthesia, opisthotonos, constipation, etc. 5. Malaria shows more distinct fever, with quotidian or tertian periodicity, and is jugulated by quinine, which has no real control over pyæmia. The discovery of the plasmodium in the blood of malaria, as well as of the typhoid bacillus in the spleen of typhoid fever, has already cleared up doubtful cases. Ulcerative endocarditis is itself evidence of septico-pyæmia.

The *prognosis* is always grave, though it varies according to the range of the disease. Light cases readily recover. High fever, profuse sweats, severe nervous signs are always grave. Metastatic deposits are ominous, though not of necessity fatal. Recovery has occurred even after affection of the eye. In every severe case recovery is tedious and protracted.

Treatment.—Prevention is easier than cure. Modern methods of asepsis shut out entrance of pus micro-organisms to large extent and thus at least prevent the epidemics of former times. Prophylaxis pays scrupulous regard to dressings, instruments, *personnel*, etc. Depots of infection are excised or laid open and washed out. Members may require amputation, the interior of the uterus curetting. Wounds are dressed with antiseptics—sublimate solutions one per cent, carbolic acid five per cent. Rutter recommends:

℞ Iodoform.....1 part.
Ether.....2 parts.
Alcohol.....8 parts.
M.

as a disinfectant wash, to be applied thoroughly into every crevice and recess of a wound. The actual cautery, Paquelin's thermo-cautery, galvano-cautery, furnish at times the finest results. In cryptogenetic cases everything depends upon the discovery of and destruction of the cause. A slow sepsis of months' duration has been stopped at once by the deep urethral injection with the Ultzmann catheter of a strong solution of nitrate of silver, gr. xx.–℥ i.; and dangerous signs have disappeared after extirpation of a diseased ovary, after a laparotomy, trephining a mastoid process, etc.

Drugs can do but little. Quinine in round dose, gr. v. every two to four hours, may help a simple case. The antipyretics are not

much indicated in the treatment of a long fever whose cause is undiscoverable or ineradicable. The body may be saturated with sublimate, small doses frequently repeated, one thirty-second grain every hour or two, or with creosote thirty or forty drops a day, as in the treatment of tuberculosis. It may become necessary to give opium to relieve pain or secure sleep. The only real address to the cause of the disease is in the exhibition of alcohol in the form of whiskey or brandy in large and frequently repeated doses. It is difficult to get the toxic effect of alcohol in a case of septicæmia. Alcohol feeds the body, lowers the temperature, and, to what extent it may, neutralizes the ferments and toxines of septicæmia. When the patient can no longer take alcohol the outlook is bad.

ERYSIPELAS.

Erysipelas (*ἐρύω*, to draw; synonym, *ἕλκω*, *ἕλκος*, wound; Latin, *ulcus*, ulcer; *πέλας*, near; Latin, *prope ab aliquo loco, i.e.*, to spread; also, *ἐρυθρόπελας*, *ἐρυσός*, *ἐρυθρός*; Latin, *ruber*, red; *πέλλα*, pellicle, skin, *vide* Stephanus, "Thesaurus linguæ Græcæ"; whence in the sixteenth century the German *Rothlauf*, *Rose*, *Wundrose*).—A specific acute infection of the surface of the body, always of local origin, and implying always a present or previous break of the surface, caused by the Streptococcus erysipelatis, marked by intense inflammation (pain, heat, redness, and swelling), high fever, gastric and nervous distress, a tendency to spread, and a liability to mixed infection (suppuration, phlegmon, gangrene), short duration, and in uncomplicated cases a *restitutio ad integrum*.

History.—Erysipelas received its name in the most remote antiquity, and was, in the earliest history of medicine, associated with wounds of the surface. Yet this association was not considered a necessity in ancient times. Hippocrates recognized an idiopathic as well as a traumatic erysipelas—a distinction which found advocates up to the most recent times. This so-called erysipelas *verum*, *s. spontaneum*, the medical, as distinguished from the erysipelas *spurium*, *s. traumaticum*, or surgical form, was in the humoral pathology an inflammation of the skin excited by the escape of "peccant matter" in the blood. Although Hippocrates and his followers included under the term many processes, suppurative, phlegmonous, gangrenous, etc., which we now consider complications, he had, nevertheless, a clear idea of the character of the disease. "In many cases," he says ("Epidemics," book iii., 4), "erysipelas, from some obvious cause, such as an accident, and sometimes from a very small wound, broke out all over the body . . . great inflammation took place, and the inflammation quickly spread all over . . . but

these things were more formidable in appearance than dangerous, for when the concoction turned to a suppuration most of them recovered."

The first vague intimation of the true cause of erysipelas is due to the penetrating insight of Henle (1840), the real pioneer of parasitism, who maintained that it was introduced by the invasion of the lowest forms of vegetable growth, which were invisible because they could not be distinguished from tissue cells; but the first distinct clinical exposition of the mode of origin of the disease belongs to Trousseau (1848), who insisted that even the medical, so-called non-traumatic cases "have almost always a starting point, which, though it cannot, strictly speaking, be called a wound, is at least a lesion, a small lesion of the integument at some point on the face [or elsewhere], such as the corner of the eye, the nose, the lips, behind the

Fig. 79.—Erysipelas cocci in the cutis (Eichhorst).

ear, or on the hairy scalp." Specific micro-organisms had been claimed as the cause of erysipelas by Nepveu (1870), Hueter, Billroth and Ehrlich, Klebs, Orth, Tillmans and Wolff (1880), for the most part in the blood, but were first definitely discovered in the skin by Koch (1881), who observed them as chain-forming cocci, streptococci, exclusively in the lymph vessels and adjoining lymph spaces, but never in the blood vessels. Fehleisen (1881), independently of Koch, made the same discovery, and by isolating, cultivating, and inoculating the micro-organism in man for therapeutic purposes, as well as in the lower animals, confirmed his conclusions and established for all time the nature of the disease.

Etiology.—The erysipelas coccus develops in serpentine form, as a bead or chain coccus, whose individual members, though very small, vary somewhat in size. It thrives in all kinds of culture soils, gelatin, agar, blood serum, milk bouillon, as well as upon the surface of the potato; with and without oxygen equally well; best at a tem-

perature of 30° to 37° C., but also at room temperature if not too low. It differs in no visible way from the pus streptococcus (Streptococcus pyogenes). Whether or not it is the same organism remains as yet an open question. Should it prove to be so, the suppurative and phlegmonous processes so often observed in erysipelas would be explained by invasion of structures—viz., the loose subcutaneous tissue—which offer less resistance than the skin. It is found in greatest abundance in the zone of tissue just beyond the region of deepest redness, still uncolored by the inflammatory process. The lymph vessels and spaces of the skin, and later of the subcutaneous connective and fatty tissues, are crowded to occlusion and distention by quickly multiplying streptococci, which have disappeared already from the visible zone of inflammation, either by reason of the short life of the organism or of consumption (incorporation) by the tissue cells and phagocytes, and not on account of the high fever they excite, as they continue to develop at 40° C., but with difficulty at 43° C., to perish in twenty-four hours at 48° C. (118° F.). They seem to perish rapidly in the blood, as they are not found in the blood vessels, though the possibility of metastasis in this way is proven by exceptional cases of intra-uterine (fetal) infection. Lebemeff found them in a section of skin of a child dead of the disease ten minutes after birth. Though Eiselsberg and Emmerich collected them from the air of surgical wards and operating rooms, as disseminated from particles of desquamated skin, there is reason to rank the erysipelas coccus with the class of saprophytes, as similar cocci are discovered in various decomposing matters, so that the parasitism of man is an accidental invasion. Hajek claims that the body of man is not a very favorable soil for the growth of the erysipelas coccus, inasmuch as it is carried only by the lymph vessels, whereas the coccus of pus (phlegmon) develops, independently of lymph vessels, in every direction. Brieger and Wasserman dialyzed from the urine of a patient affected with consecutive nephritis a toxalbumin fatal to mice and guinea pigs. With resolution of the erysipelas and nephritis the urine ceased to be poisonous.

FIG. 80.—Streptococcus erysipelatis: colony in a lymph vessel, ear of rabbit, two days after inoculation (Ziegler).

Age, sex, season, soil, have no influence in the production of the disease, which owes its origin exclusively to a specific cause, and which, once established in a house or institution, may develop upon the surface of any, even the most trivial, break of the surface—mere abrasions, leech bites, old granulations, slight fissures, etc.—in a susceptible individual. Vaccination had to be suspended in Boston in 1851 on account of the frequency of erysipelas infection—an accident

put beyond the suspicion of a mere sequence in the experience of Doepp, who infected every one of nine children by the use of lymph from a child that showed erysipelas on the following day.

The erysipelas streptococcus has no power of attacking or dissolving sound skin, but may easily penetrate the delicate connective tissue which constitutes a new cicatrix. König found in nineteen of thirty-six cases of "spontaneous" erysipelas a slight injury, which could not be recognized in the rest on account of the great swelling of the affected tissues; and Volkmann declares that scarcely an exception can be found where "idiopathic" erysipelas does not start from a wound, as from a scratched pustule or some such break. Auto-infection with the finger nails is an interesting illustration of this point. A medical student, under the observation of the author, affected with erysipelas of the face, reinfected himself in the leg by scratching, and quickly succumbed to the double infection. Here, too, it must not be forgotten that light lesions, visible points of previous infection, may be healed to leave no trace in twenty-four hours.

The disease spreads for the most part by direct contagion (*i.e.*, from bed to bed in a hospital ward), and remains thus confined to closed apartments—hospitals, prisons, ships, etc. In St. Bartholomew's it spread by attacking the nearest patient with an open wound. In the Berlin Charité erysipelas was confined, on one occasion, to the various occupants of certain beds directly over a defective privy pipe, the repair of which put a stop to the disease. Radcliffe discovered and removed a similar cause of erysipelas in Oxford, in 1874, in choked sewer pipes. A still more instructive case occurred in the Middlesex Hospital, where erysipelas was strictly confined to two beds, successive occupants being invariably attacked; with the repair of a flaw in a privy pipe, finally discovered in the adjoining wall, the disease disappeared for a time, to return in the same way after the lapse of ten years. Mindful of former experience, the pipe was again examined and again found defective; on mending it no new case occurred (Zuelzer). Goodfellow reports a successive attack of every patient in a ward of thirteen beds, the disease going regularly down one side and up the other.

Erysipelas thus rarely assumes epidemic proportions and seldom spreads over an entire community. Yet the germ may be conveyed by third persons or things, as by clothing, bedding, instruments, utensils, and cases of apparently spontaneous origin find explanation in this way. Thus, in a light epidemic at Rostock, König observed that the disease was confined to patients operated on in the amphitheatre, and the cause was finally located in some blood-saturated pillows, the substitution of which by clean pillows ended the cases. A rabbit inoculated with an aqueous infusion of these pillows was affected with a diffuse dermatitis which lasted twelve days.

Overcrowding in hospitals, as during the existence of other epidemics or during war, furnishes the conditions which favor the spread of the disease. This was so often the case in our civil war "that it was frequently deemed desirable to establish 'erysipelas wards' for the isolation and better treatment of those affected" (Woodward). Yet in all cases the specific cause must be first introduced. Thus, Calmeil relates that the Paris hospitals were crowded with patients affected with erysipelas in 1828; Schönlein observed an extensive epidemic in the hospital at Zürich in 1836; Gintrac described a similar occurrence at Bordeaux in 1844, where every incision, cauterization, vesication, or venesection served as the starting point for an attack; Trousseau remarked upon the coincidence of puerperal fever in the Paris Maternité in 1858 with grave erysipelas in the surgical division. In this connection it may be mentioned that Doyen (Rheims) declares that he was not able to discover a streptococcus among the micro-organisms of the vagina, so that it must be always carried to the uterus by hands, instruments, etc. But while pyæmia and gangrene were very frequent, erysipelas was almost unknown during the Crimean war, and Volkmann did not see a single well-marked case in Tratenau and other hospitals in 1866, where about one thousand wounded were quartered. And while the disease was very infrequent in quickly established and necessarily badly kept lazarettos in France, it attacked fully two per cent of the wounded in the "well-situated" hospitals of Berlin.

The period of incubation is very short—but one or two days as a rule; exceptionally, according to Heiberg, the temperature rose in the Rostock epidemic in two hours after a surgical incision. One invasion is said to rather predispose to than prevent subsequent attacks, though most cases of so-called habitual erysipelas are mere erythemas, simple dermatitis, carbuncles, drug eruptions, etc.

Symptoms.—Erysipelas is usually introduced by a *chill* or series of chills, with *malaise*, *anorexia*, *nausea*, sometimes vomiting, *headache*, sometimes *delirium*, scanty urine, hot, dry skin, and *fever* in varying degrees of intensity. The temperature rises rapidly to 102° to 105° F., to fall in three to five days, or reascend later with each new extension of the disease. The general symptoms are due to the development of a chemical poison, *toxine*, since the streptococcus does not enter the blood.

The *eruption* or local manifestation shows itself most commonly about the face (in twenty-eight of forty-two cases—Heyfelder), on account of its greater exposure. The region of the nose is the most frequent starting point; nose twelve, ear six, eyelids five, scalp five, etc. And this predilection for the face is observed even though

wounds of the extremities are twice as frequent (Billroth)—a fact which of itself demonstrates outside infection.

The eruption appears as a *rose-red flush*, which rapidly spreads from the part affected like red ink over blotting paper. The skin is *swollen, glazed,* and *œdematous;* pits hence on pressure, and burns as if scorched by fire.

If the nose be the starting point, the disease spreads toward the lips, ear, forehead, scalp, nucha, but not downward over the chin. Commencing elsewhere, as at the back of the neck or scalp, it pursues a reverse course, but still respects the chin. From the breasts it extends toward the axilla and over the chest, but does not pass down over the xyphoid cartilage. The germ follows the rhombic meshwork of the skin (as indicated by the lines of tension or elongation after a circular punch), along which the lymph vessels course, and meets with obstacles where these lines cross, as at the chin and ensiform cartilage, or where the skin is bound down to bone or subcutaneous tendons. Visible tongue-like or dendritic prolongations may reveal its progress in this way up to adjoining lymph glands, which show invasion by tenderness and swelling; or wall-like indurations may indicate its advance *en masse, erysipelas marginatum.* Vesicles, always visible with a lens, and blebs frequently form on the affected surface. Barring exceptional cases (*erysipelas fixum*), the disease does not last longer than four days in one locality, though previously affected regions may be revisited as a result of reinfection. More widely or rapidly advancing cases constitute *erysipelas migrans, s. ambulans, s. serpens.* Vaccinal erysipelas in a feeble child may thus spread over the whole body in less than a week.

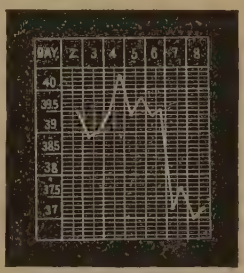


Fig. 81. — Temperature (Celsus) in severe facial erysipelas (Eichhorst).

The deep discoloration, more especially the great swelling, *œdematous infiltration,* of the parts affected, produce deformities quite characteristic of the disease. The eyelids are puffed to complete closure, the nares blocked, the ears bloated, the lips protuberant, the face seems a shapeless mass or repulsive mask like that shown in small-pox. Drops of sticky serum ooze out upon the glazed surface from ruptured blebs, to add to the picture of distress. *Infiltration of the scalp* gives it a doughy sensation to the touch, lifts it from the cranium, or interferes to such extent with the nutrition of the hair as to cause it to fall—defluvium capillitii—to be restored, however, in all cases with the subsidence of the disease. The back of the neck may present the appearance and give the discomfort of a huge carbuncle.

At this time, during the height of the disease, there is always more or less *delirium, muttering, insomnia,* or more frequently *somnolence and coma,* more rarely mania, especially at night. The tongue is heavily coated, fuliginous; the spleen is swollen; the bowels constipated; the urine scanty, and albuminous from fever; and complications of various kinds, some of great gravity, are liable to ensue. But just at this time, as a rule about the fourth or fifth day of the disease, when the gravest apprehensions are being entertained, resolution sets in, occasionally with epistaxis or herpes, more rarely with suppuration, with fall of temperature, subsidence of swelling, frequently with desquamation of the skin, and in an incredibly short time there is *restitutio ad integrum—i.e.,* to leave no trace of previous affection. And so, "as if by magic, a hideous monster was metamorphosed into a comely damsel" (Watson). The disease lasts usually three to ten days.

Erysipelas is not confined to the outside skin. It may originate in or subsequently *invade also the various mucosæ,* to produce the same changes as in the skin. Gerhardt thinks it questionable that we should regard all internal affections occurring during the course of erysipelas as directly caused by the disease, though he admits the possibility of an intimate connection with pericarditis. Diseases of the mucosæ by extension from the skin or from border lines would seem to admit of no other explanation. So also subsequent extension from the mucosæ to the skin, with typical manifestations in the skin, furnish evidence satisfactory to diagnosis. Thus, to quote one case from a now crowded literature, Wells reports an erysipelas faucium, characterized by fever, thirst, headache, swollen glands in the neck, pharyngeal œdema and redness, with phlyctenulæ, subsequent invasion of the nose, and in forty-eight hours of the face, with typical signs, and final recovery. Pozzi speaks of erysipelas of the nose, ear ducts, external auditory canal, drum cavity, and Eustachian tube. Cordone remarks that hitherto pharyngeal erysipelas has been considered secondary because of the absence of proof of primary affection by bacterioscopic examination. This proof he claims to have furnished in four cases of what he calls "unconditional" erysipelas. In all these cases fluid withdrawn from phlyctenulæ in the throat by a sterilized syringe furnished, among other micro-organisms, Fehleisen's streptococcus, as demonstrated by subsequent cultivation and inoculation experiments. The pharynx offers a favorable nidus for erysipelas, he says, because of the richness of its lymph plexus. Thus in the throat erysipelas may simulate diphtheria or scarlet fever, the deeply reddened surface becoming swollen, tense, and œdematous; in the larynx it may assume the sudden gravity of œdema of the glottis. The vagina is less frequently involved, but

the coincidence of erysipelas with puerperal fever, already noticed, shows involvement also of the uterine mucosa.

Complications.—Abscess of the skin, gangrene, bronchitis, pneumonia; more rarely, œdema of the glottis; more frequently, endocarditis, pericarditis, meningitis; icterus, dysentery; more rarely, enterorrhagia, ulcer of the duodenum, peritonitis; according to Hartmann certain cases of "spontaneous peritonitis are caused by the erysipelas coccus"; nephritis; Cerné claims to have found the streptococcus in the urine; affections of the joints; exceptionally parotitis, keratitis, amaurosis, panophthalmitis; paralysis.

Diagnosis.—Erysipelas is written upon the surface in its *intense redness and swelling*, origin about a wound, characteristic *deformity, fugacity*, and *restitutio ad integrum*, together with the constitutional distress and complications. It is distinguished from erythema by the more tense, glazed, and œdematous condition of the skin, arising about a broken surface, by its more strict localization, blebs, indurated margins, fever, with other signs of toxæmia which do not belong to erythema. Erythema nodosum, though associated with fever and often with gastric distress, is recognized by its nodosities, especially about the joints. Drug eruptions after the antipyretics, copaiba, etc., have a history, less severe local, and no constitutional signs. Malignant pustule (milzbrand) and malignant œdema, rare affections, show characteristic bacilli; erysipelas, characteristic micrococci.

Prognosis.—The prognosis is favorable as a rule, for, as observed by Hippocrates, the disease is more "formidable in appearance than reality." The occurrence of suppuration, which is comparatively rare, and is certainly indicative of mixed infection, does not aggravate it greatly. "Verum ac legitimum erysipelas raro terminatur suppuratione, sed magna ex parte insensibili transpiratione seu resolutione" (Vidus). Previous debility reduces the rate of recovery, and symptoms on the part of the nervous system are especially threatening. Rapid spread, undue protraction, reinfection, relapses, complications, gravely affect the natural tendency to resolution.

Prophylaxis is difficult on account of the extreme tenacity of the streptococcus, which fixes itself to walls, carpets, curtains, bedding, almost ineradicably. Ferraro propagated erysipelas from streptococci kept dried on a silk thread fifty-two days. Walls should be rubbed down with bread; furniture disinfected by long ventilation in the open air; rooms flushed with fresh air day and night; floors scrubbed with corrosive sublimate; bedding, clothing, etc., subjected to steam heat or destroyed by fire; patients isolated as much as may be. Attendants should not wear woollen clothes. Above all things, instruments, best wrapped in towels, should be placed in

boiling water for five to ten minutes, and utensils thoroughly scalded out.

Treatment.—The treatment of erysipelas is based upon attempts to destroy or limit the extension of the streptococcus, and to support the patient during the progress of the disease. Fehleisen found that thin layers of the streptococcus perished in a one-per-cent solution of carbolic acid in forty-five seconds. Gärtner and Plagge declare that cocci cultivated in bouillon feel the deleterious influence of a three-per-cent solution of carbolic acid in eight to eleven seconds. Hartmann observed all streptococci, wet or dry, perish under five to ten minutes' exposure to undiluted liquor ferri sesquichloridi, which absolutely destroys those on the surface, but only limits or checks the development of those deeper in the tissues. These facts furnished by the bacteriologist give the clue to the scientific treatment of the disease, as well as explain the failure of specific treatment hitherto.

Mild cases require no treatment beyond wet compresses or inunctions to relieve the heat and tension of the surface. More severe or rapidly spreading invasions may be attacked by antimycotic agents, at the head of which stand the agents mentioned. External applications are obviously useless. The fact that so many practitioners of the "school of experience" possess specific applications, each different from the rest, is patent proof of the inefficiency of all of them. Scientific disproof of such specificness is offered in the report of Polotebrow (1888), of St. Petersburg, who made parallel observations in sixty cases, thirty of which were treated with cold-water compresses alone and thirty with energetic applications of nitrate of silver—4 : 30—over the affected surface and two or three fingers' breadth beyond it, without influence on the temperature, nervous symptoms, albuminuria, or other complications, and without appreciable difference in the duration or mortality, which was one in each set of cases. Hueter first employed carbolic acid subcutaneously, introducing the agent beyond the limit of invasion. This treatment, which is admirably adapted to the trunk or extremities, is impracticable about the face or scalp. Bogusch recommends the subcutaneous injection of resorcin 1.5 : 30 aqua destillata; Cattani, the application of the same agent, two- or three-per-cent solution, every two hours, externally by means of a brush or saturated cotton, together with its internal administration (4 : 6) in water, barley water, or red wine. Hücker advises the painting of the surface with cocaine in relief of pain. Hofmokl applies compresses of a three- to five-per-cent solution of carbolic acid, and covers them with some material impervious to water. Lovanz paints the surface repeatedly with a mixture of ichthyol twenty, glycerin and ether

each ten. Duckworth uses an ointment of equal parts of chalk and melted fat. Barwell applies white lead as quickly and as thickly as possible. The Berlin Charité paints the surface with a concentrated solution of carbonate of lead in glycerin, and covers it all in with cotton. Popoff applies with a brush trichlorphenol, five-per-cent solution, in glycerin. Winiwarter claims to check the spread of erysipelas migrans as follows: The affected surface is washed, or, if the extremities, bathed, in a three-per-cent solution of corrosive sublimate. Next is applied to it, and to two fingers' breadth beyond it, a thick layer of tar, which is now covered in. The covered surface becomes macerated in a few days, and is next redressed with sublimate water in but one-per-cent solution, which thus checks the further advance of the disease. Much more radical treatment is practised by Kraske, who makes multiple punctate scarifications and small incisions one centimetre long through the corium, and in places through the whole skin, washes over and rubs into the surface a five-per-cent solution, and covers it all in with compresses saturated with a two-and-one-half-per-cent solution of carbolic acid.

A recent remedy, highly lauded, is:

℞. Iodoformi,
Creolini ..... āā gr. xv.
Unguenti petrolati ..... ʒ ss.
Lanolini ..... ʒ iss.
M. Apply with a brush.

The use of this preparation is said to check fever and stop the spread of the disease after three applications. Wölfler claims to have cut short fifty-eight of sixty cases by strapping the surface with adhesive plaster.

The real value of any or all of these remedies remains to be tested by time. They seem at present to show the direction of modern therapy as determined by etiological discovery.

Few practitioners will now maintain a specific action for any internal remedy, though none will deny the necessity of sustentation of the patient by alcohol, if necessary, until the disease shall have run its course.

The natural tendency of the disease to resolution in the course of a few days makes it difficult to decide whether any "cure" be due to Nature or to art.

It is wise to keep the bowels open with calomel and Carlsbad salts, to allay nausea and vomiting with small doses of chloral, gr. ii.–v. in peppermint water. Here, as everywhere, "*ubi pus, ibi incisio.*"

ANTHRAX.

Anthrax (ἄνθραξ, coal); carbuncle; malignant pustule; splenic

fever; German, *Milzbrand;* French, *charbon.*—An exquisitely acute, often fatal infection, caused by the Bacillus anthracis; characterized by the formation of a boil with a black centre (anthrax), extensive circumjacent infiltration, and subsequent sepsis; in internal form by rapid toxæmia and the development of metastatic carbuncles in the skin.

History.—Anthrax existed in the most remote antiquity. It is recognized that most of the fatal plagues which chiefly affected animals, and not infrequently men, correspond to the symptomatology of anthrax. The plague of murrain with boils and blains, on man and beast, mentioned in Genesis, is believed to have been anthrax (Blanc).

The Bacillus anthracis (Pollender, 1855) is famous as the first micro-organism discovered as the actual cause of an infectious disease. It is the longest known and best studied of all the micro-organisms.

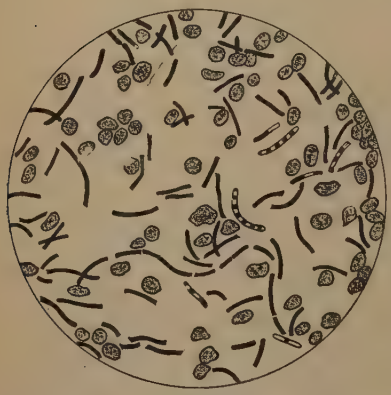


FIG. 82.—Anthrax bacillus, with and without spores, from spleen (Woodhead and Hare).

Etiology.—The milzbrand bacillus is a motionless rod of elongated, jointed cells, 0.005 to 0.0125 mm. in length—*i.e.*, two to ten times as long as a red blood corpuscle—0.001 to 0.0015 mm. broad. Under proper conditions it forms in the culture soil, but never inside of the body or tissues of the living animal, endogenous spores. Decomposition, the action of the gastric juice, quickly destroy the bacilli, but fail to attack the spores. The ingestion of meat free of spores produces no infection. The ingestion of meat with spores infects infallibly. In San Domingo (1770) fifteen thousand persons perished in six weeks from eating the bodies of animals dead of the disease. Freezing affects neither the bacilli nor the spores.

Anthrax infects chiefly herbivora, next omnivora, least carnivora, man as an omnivorous animal. The disease is therefore not quite so dangerous in man as in some other animals. The Bacillus anthracis is a saprophyte. It goes through with all its phases of development outside, and makes only accidental incursion into, the body of man. Martin succeeded in extracting from cultures certain chemical products: first, proto- and deutero-albumose; second, an alkaloid; third, small quantities of leucin and tyrosin. Mice injected with the proto- and deutero-albumose were affected with œdema at the place

of injection, and with a sufficient quantity (0.3 gramme for a mouse weighing 22 grammes) they were killed. Similar symptoms were produced with the alkaloid (0.1 gramme fatal to a mouse weighing 15 grammes). Hankin also found an albumose which he injected in prophylaxis against the disease. Anthrax is peculiarly malignant in small animals. It is so surely and quickly fatal to mice, guinea-pigs, and rabbits as to make their bodies the best physiological tests in cases of doubt as to the nature of a micro-organism.

Anthrax is usually conveyed to man by contact with a diseased animal or by the ingestion of its flesh as food. Individuals most closely connected with cattle are chiefly affected—butchers, stable boys, shepherds, veterinary physicians, etc. On account of the great tenacity of the spores, people who come in contact at any time with the skins, hairs, bristles, cloths, horns, hoofs—as tanners, brushmakers, upholsterers (horse-hair), wool sorters, rag sorters, glue makers, etc. —may be affected through open wounds in the skin or through inhalation of dust.

Since Bollinger demonstrated the bacillus in the stomach of carnivorous flies, and with Raimbert and Davaine produced the disease by inoculation with the stomach, legs, and feelers of these insects, it must be admitted that malignant pustule may be conveyed by insects. It had long been remarked that malignant pustule occurs more especially on the exposed parts of the body—face, hands. Bell, of Brooklyn, found fifty-six of sixty cases on the face, two on the hands, one on the wrist, and one on the forearm. It was evident that the bite of a fly or mosquito had often originated the disease. Extensive epidemics have been caused, as stated, by the ingestion of raw or insufficiently cooked flesh. Animals rarely contract the disease from each other ; they get it from the soil. It has often been observed that certain regions are centres of infection where the disease shows itself year after year. The superficial burial of carcases leads to infection of the soil, which, once produced, is seldom eradicated. The disease is spread chiefly in the warm months of summer, when the soil is softer, by grazing upon its surface, and is transported by streams of water which convey infected soil to a distance. Floods may disseminate the disease to places previously free. Stable utensils, fodder, hay from anthrax fields, litter, harness, surgical instruments, have been known to convey the disease. The fœtus is not infected as a rule. The placenta, when sound, acts as a filter. Exceptional cases have been accounted for by lesion of the placenta. Immunity is not secured by a single attack.

Symptoms.—The disease presents itself in two distinct forms, one as it originates externally, the other internally. The external

disease is the anthrax, malignant pustule, or charbon, with its lesions in the skin and subjacent tissues. The internal is the intestinal or thoracic mycosis, which is recognized by the general signs of toxæmia, the nature of which may be, if unsuspected, overlooked. The external disease is confined to individuals ; the internal may assume, as stated, endemic and epidemic proportions.

The period of *incubation* varies from one to several days. Symptoms may show themselves in a few hours after inoculation. They may be delayed as late as four days. A slight *itching, prickling,* or *burning sensation* is first perceived on the face or neck at the site of inoculation. Sometimes the patient feels as if he had been just stung by an insect. Very soon appears a *papule with a central vesicle,* the rupture of which discharges bloody contents, to be converted into a dark *red-brown or black crust*—the anthrax. Smaller vesicles may appear about it. The parent nucleus, as Virchow called the first eruption, rapidly extends ; the skin swells about it, becomes indurated, livid, and hard. The subcutaneous tissues are extensively infiltrated with serum. The appearance is characterized as a " brawny œdema," which rapidly spreads to involve a mass of tissue, the whole of one arm or of one side of the neck, in the course of a few days. *Lymphangitis* and swelling of the lymph glands, with *phlebitis,* are frequent complications. For the first day or two there may be no disturbance of the general health, the patient may even continue at work ; but toxic signs set in, as a rule, by the end of the second day, with *delirium, diarrhœa, sweating, vomiting, and collapse,* and so the patient may die of heart failure in five to eight days. This result, however, is not so frequent as was formerly supposed. In the majority of cases the local inflammation begins to abate in the course of a few days. The anthrax sloughs off and the subjacent ulcer closes over by granulation.

A sub-variety of this condition was first described by Bollinger as *anthrax œdema.* In this form the local lesion is absent. The poison seems to be introduced more deeply into the tissues, and chemical products produce an œdematous state of wide range. This variety is most often noticed in the region of the eyelids.

The internal mycosis announces itself more distinctly as an infection. The disease begins suddenly with *chill, pain in the head and joints, vomiting, and diarrhœa.* The case looks like a poisoning, which it is. *Free hæmorrhage* may occur from the mouth, nose, and kidneys. Nearly always (exceptions by Bonisson) there is an outbreak upon the skin of small, phlegmonous, carbuncular inflammations, the so-called *metastatic carbuncles.* There is usually but little fever. There may be much *delirium, convulsions,* sometimes opisthotonos. There is often *præcordial anxiety and intense*

dyspnœa. Cyanosis and heart failure usually precede the termination, which may occur in the course of a very few days.

Where the disease originates in the chest respiration soon becomes difficult, though auscultation reveals, as a rule, only the signs of a light bronchitis. Diarrhœa is usually absent. The nervous system may be depressed, or so little affected as to lead patients to decline medical advice, even a few hours before death. The case bears the aspect of a rapidly spreading pneumonia with heart failure. Most of these cases succumb in three to five days. Bell declares that they who survive for a week recover. This form of the disease has been observed more especially among the sorters of wool. Most of the fatal cases have been hitherto unrecognized. Bell thinks that many of the cases diagnosticated as pneumonia, bronchitis, congestion of the lungs, etc., occurring in factories of carpets, blankets, furs, etc., are really cases of thoracic anthrax. It is not improbable that some of the cases ascribed to poisoning by mushrooms, meat ptomaines, etc., are really cases of intestinal anthrax.

Diagnosis.—Anthrax is distinguished by its origin as a *red papule with a dark centre—"gran nero"*—and its rapid extension with *brawny œdema.* The black central crust is absent, and any extensive surrounding inflammation is absent, in a common boil or furuncle. There is a furunculosis of the upper lip which is more fatal than anthrax (König). Carbuncles show themselves much more frequently on the back of the neck, trunk, and extremities; anthrax occurs on uncovered surfaces. Anthrax spreads from one central point or parent nucleus; carbuncle results from the coalescence of a number of points. Anthrax œdema, in the absence of a central papule, is distinguished by its sudden appearance, its yellow-greenish hue, and septic symptoms. Erysipelas is more superficial, has no anthrax or parent nucleus, and shows no bacteria in the blood.

FIG. 82.—The anthrax bacillus in the blood.

The diagnosis of intestinal and thoracic anthrax is sometimes reached only by exclusion. The nature of the avocation, the exposure to the cause, is the most common index to the condition. The sudden occurrence, in the midst of health, of the intense signs of a grave infection—headache, nausea and vomiting, dyspnœa, cyanosis, convulsions, free hæmorrhages, especially of skin carbuncles—in connection with the history of exposure, should lead to the recognition of the disease. In any case of doubt the diagnosis may be established by the examination of the blood under the microscope, or by a physiological test. A rabbit, guinea-pig, or a mouse shows dyspnœa, dilatation of the pupils, and convulsions, with death in the course of

two or three days after inoculation. The blood of these animals then swarms with bacilli.

The *prognosis* is always grave ; that of malignant pustule depends upon the stage of its recognition. The disease can be always eradicated at first. In places where its picture is familiar, and where the disease is attacked at once, the mortality is reduced to five to nine per cent, and even this mortality is ascribed to delay in treatment. Under neglect the mortality may reach fifty to sixty per cent. Intestinal and thoracic anthrax, recognized only after general infection, have always, at least at present, a fatal prognosis.

Prophylaxis consists in the proper disposition of the bodies of dead animals by deeper burial or by cremation ; by the avoidance of the use of the hides or other products of these animals ; by the destruction of their discharges, as by fire ; by shutting off affected pasture fields, damming up streams of water, etc. ; by the abundant use of disinfectants—carbolic acid, chloride of lime, corrosive sublimate—in handling suspected wools, horns, and other products ; and by protective inoculation of cattle and sheep with attenuated cultures or antitoxines—a procedure the value of which is yet *sub judice.*

Treatment.—The successful treatment of anthrax depends upon the energy of the local attack. Deep crucial incisions should be made through the substance of the mass, and the gaping cuts stuffed with carbolic acid fluidified by heat. They should be afterward dressed with the more dilute solution 1 : 10. Individual carbuncles may be excised *en masse* or excavated with a sharp spoon, whereupon the base must be treated with powerful caustics—carbolic acid as stated, corrosive sublimate, caustic potash, etc. Camera best expresses the principle of treatment with the most successful practice in countries where the condition is most frequently encountered, as follows : The mass is to be circumscribed by a deep incision and penetrated by numerous crucial incisions. Into the bottom of all these cuts is to be strewn corrosive sublimate itself, in powder, 0.04 to 0.15. The liquefaction of the sublimate produces extensive, thoroughly penetrating destruction of the entire mass. Where the surface is so great as to lead to the fear of poisoning by the sublimate itself, its action may be modified and poisoning prevented by admixture with a proportion of calomel. Weil first anæsthetizes the mass with cocaine, scoops it out, and applies to the wound dressings saturated with a one-per-cent solution of corrosive sublimate. Contento injects into, under, and about the mass subcutaneously three-per-cent solutions of carbolic acid. In the œdematous form the whole infiltrate must be abundantly scarified and cut deep down to the healthy tissue in the same way, and dressed in solutions of iodine and carbolic acid.

In the cases of general infection metastatic carbuncles are to be treated in the same way, and the patient supported with brandy or subcutaneous injections of ether, camphor, or other analeptic.

The therapy of internal anthrax is well-nigh hopeless. Where it is known that poisoned meat has been ingested, the stomach should be immediately washed out, or a powerful emetic administered, followed by a purgative dose of castor oil. For an internal mycosis it has been recommended to administer carbolic acid in dose of three to five drops three or four times a day. It might be better to saturate the blood with creosote, as in the treatment of the sepsis of tuberculosis; and with alcohol, as in poisoning by snake bites. Not much hope is to be entertained from either plan. The hope which seemed justified by the experiments of Fodor regarding protection by saturation of the blood with an alkali, has proven futile according to the subsequent investigations of Chor. Future success must be obtained by means of sozines or antitoxines. Hankin, of Cambridge, finds certain defensive proteids in the serum of the blood of certain animals. There is a protective albuminoid, a non-dialyzable globulin insoluble in alcohol and water, in the blood and spleen of a rat, which renders a mouse immune against the most virulent anthrax. Kostjurin and Krainsky reached the conclusion that certain toxines from decomposition, introduced at the proper time into the bodies of rabbits affected with anthrax, totally prevent the development of the disease. Ogata and Jasuhara claim that the blood of animals, dogs, fowl contains a ferment which, injected subcutaneously in but one- or two-drop doses, acts as a preventive and curative remedy. These disclosures of much promise have not yet been utilized in the treatment of anthrax in man.

FOOT AND MOUTH DISEASE

Latin, *aphthæ* (ἅπτω, to fasten) *epizooticæ;* German, *Maul-klauenseuche;* French, *stomatite aphtheuse;* Italian, *febbre aftosa.*—A mild, acute infection of the lower animals, especially of cattle, sheep, pigs, less frequently of the goat and horse, much more rarely of fowl, dogs, cats, evidently caused by a peculiar microorganism not yet exactly defined; characterized by the formation of vesicles and ulcers in the mucous membrane of the mouth, with the development of eruptions and ulcers in crevices about the feet, sometimes about the udder; communicable to man for the most part through the milk of diseased animals, to appear, with malaise and light fever, as vesicles and ulcers in the mouth, of benign course and short duration.

History.—The disease was recognized in animals in antiquity, but was, in the early history of veterinary medicine, evidently con-

founded with anthrax and actinomycosis. Hertwig (1834) established the contagiousness of the disease by experimenting upon himself and two other medical men. They drank daily for four days a quart of fresh milk from diseased cows. Symptoms of fever, headache, dryness and heat in the mouth, and itching in the hands and fingers began in two and lasted for five days, at the end of which time vesicles appeared in the mouth. The disease has now, therefore, a recognized place in human pathology. Though benign in its manifestation and course, it is nevertheless a serious affection from the fact that so many young animals, sucklings, succumb on account of degradation of the milk. It is stated that in many epizoötics as many as seventy-five per cent of sucking calves perished. The disease, once developed, is exceedingly persistent. Stables remain infectious for a long time. It is gradually transported along the lines of travel, hence along the course of rivers, and with a general tendency westward, to assume at times very wide range. Thus in the year 1871 seven hundred thousand animals were attacked in England alone, entailing in the same year in France a loss of thirty million francs. In 1869 the disease ranged over nearly all Europe. It makes up for its mildness by its range, and costs a country more than the malignant diseases, anthrax, glanders, and rinderpest.

Etiology.—The infectious principle, evidently a micro-organism, has not yet been distinctly isolated. It is certainly distinctly communicable by inoculation. Nesswitzky (1891) conveyed it with the contents of vesicles and secretions of ulcers, as well as with milk. Inoculation failed in the experiments of the Berlin Health Office in 30.3 per cent of cases. Klein, Siegel, and Schottelius isolated micro-organisms, but with no other proof of pathogenesis.

The disease shows itself in the lower animals as a mild fever attended with a catarrhal inflammation of the mucosa of the mouth and the formation of vesicles and pustules about the feet. The *milk* of the affected animal *is altered in quantity and quality.* It is *reduced* often as much as *one-half in man,* assumes a *yellowish colostrum-like appearance,* and *coagulates prematurely.* It has a *bitter, nauseating taste* and deposits a dark-yellow sediment. The disease terminates usually in twelve to fourteen days.

Man is usually affected through diseased milk, which retains its infection even when added to coffee or when diluted with normal milk in the proportion of one to ten. Boiling absolutely destroys the poison in the milk and renders it perfectly harmless. It is doubtful if the disease may be conveyed by the meat of diseased animals, but instances of infection have been reported from the ingestion of butter and cheese made from the milk of diseased cows. Infection by

direct inoculation, as in milking, is not uncommon in those who have the care of diseased animals.

The chief interest in connection with foot and mouth disease occurs in relation to *aphtha*, which is declared to be the expression of the disease in man. It has been observed that aphtha prevails in children coincidently with outbreaks of the foot and mouth disease in cattle. What lends also especial support to this view is the fact that the appearance of the disease is much the same in man as in the animals.

Symptoms.—The period of incubation in man ranges from three to five days. The disease may begin with *chills*, or chilly sensations, followed by *fever, anorexia, and malaise. Vesicles* now appear upon the *inner surface of the lips and tongue.* Along with the sense of heat and dryness there is *difficulty in speaking, chewing, and swallowing.* The mucous membrane is very much reddened and swollen, and *saliva flows abundantly.* There is often noticed also at this time a vesicular eruption on the fingers and hands, sometimes in association with intestinal disturbance. The *vesicles upon the fingers* are at first small and transparent. They soon increase in size and change in color to show purulent contents, and sometimes closely simulate the eruptions of small-pox. Cases have been reported where the eruption was so extensive as to cover the entire body (Biercher). Holm saw vesicles on the nipple of the breast in a woman who drank daily large quantities of milk from cows affected with the disease.

The catarrhal inflammation may assume such proportions as to constitute an extensive stomatitis. Briscoe saw a case in which the tongue was so much swollen as to project more than an inch from the mouth.

Prophylaxis includes proper care of the animal regarding pasturage and stables. Man is best protected by the ingestion of milk from healthy cows, or, if that be impossible, by the thorough boiling of milk from diseased cows.

The *diagnosis* is usually easy. It may be known that the disease exists at the time in animals. The peculiar coincidence of eruption in the mouth and extremities, sparing the rest of the body, is unlike any other eruptive disease. Thus the mycoses of the mouth are unattended with affections of the feet, and eczemata, etc., of the feet are unassociated with eruptions of the mouth.

The *prognosis* is favorable. The disease runs a mild course, and terminates, as a rule, in from five to eight days. Extensive affection of the hands, with the difficulty of proper protection, may extend the disease to several weeks. Fatal cases have been reported in very delicate children.

Therapy.—Stomatitis is best treated with weak solutions of borax as mouth washes. Erosions and ulcers should be cauterized with the nitrate of silver, which not only protects an abraded surface from irritating contact, but also by its antimycotic properties directly addresses the cause of the disease. The superficial lesions of the extremities may be best treated by lead washes, diachylon ointment, light bandages, etc. The fever and general distress of infection may call for mild or repeated doses of salicylates, phenacetin, chloral, or Dover's powder.

GLANDERS.

Glanders (from gland); farcy (from *farcio*, to stuff); Greek, *μάλις*; Latin, *malleus*, *maliasmus*; German, *Rotz*, *Wurm*; French, *morve*.—An infection, acute or chronic, of the horse and allied solipeds, ass and bastards, communicable by inoculation to many domesticated animals (but not to cattle) and to man; produced by the Bacillus mallei; characterized by the formation of nodules (granulomata) and ulcers in the mucous membrane of the nose, with discharge of fetid pus, as from glands (whence glanders), and also by deposits in the skin and subcutaneous lymph structures (whence farcy), and subsequent general infection.

History.—Apsyrtus, a veterinary surgeon in the army of Constantine the Great, is credited with having made the first mention of glanders, under the name *malis*, a term which included, however, many other maladies. Vegetius also spoke of it, and Aristotle described it in asses. The disease had in former times a much more intense interest, in that to it, at various periods, was credited the origin of syphilis, tuberculosis, scrofula, diphtheria, and pyæmia. The chief interest of glanders at the present day is in connection with diseases of the horse.

Schilling of Berlin, and Muscroft of England, recorded accurately studied cases in 1821. Rayer published the first monograph in 1837. Virchow contributed exhaustively to the pathology of the disease in 1855–63.

Etiology.—The question as to the possibility of spontaneous origin was definitely denied with the discovery by Löffler and Schütz (1882) of a specific bacillus—the Bacillus mallei—which these observers isolated, cultivated, and inoculated to reproduce the disease in the horse.

The bacillus of glanders much resembles in form and size that of tuberculosis and leprosy, though it is shorter and more slender than either. It is immobile; maintains its virulence desiccated for three months; is readily colored with alkaline aniline dyes. It forms a characteristic colony on the surface of a potato, as a delicate yellowish,

transparent coat, like a thin layer of honey, as early as the second day. Acting upon the method of Koch with tuberculin, Kalning, of Dorpat (1891), succeeded in extracting from cultures a product which he proposed to use in prevention and treatment. Most unfortunately Kalning fell a victim to the disease; but his studies were taken up by Preusse of Dantzic, and Pearson of Berlin, who also succeeded in extracting a dark-yellow, rather opaque, oily fluid of peculiar odor and neutral reaction, which they called malleïn, and with which they obtained characteristic reactions in horses affected with the disease.

The original seat of the disease in the majority of cases is the nasal mucous membrane, whence it may be disseminated through the body, to show itself more especially in the skin. The disease may be always recognized unmistakably by the examination of tissue exsected from the masses in the nose or in the skin. It is not readily recognized in fluid secretions, as it is easily destroyed by other bacteria. Field mice may not be used for the physiological test, as they are so exquisitely susceptible to the bacteria of septicæmia. The guinea-pig is to be preferred, as offering a much more exclusive soil.

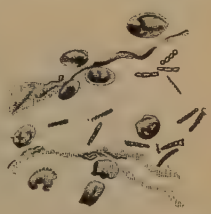


Fig. 84.—The bacillus of glanders

The disease is disseminated, as stated, through the lymph vessels and also through the blood vessels, and is communicated to man either through a broken integument, especially in the nose, during the process of currying or feeding, or other contact with diseased horses, especially in slaughtering, skinning, tanning. It is sometimes, but much more rarely, conveyed by the ingestion of infected meat—a mode of infection much more common in animals fed upon horse flesh, as in menageries. The most unsuspected and unavoidable source of infection, fortunately of most rare occurrence, is that which occurs in inhaling into the nose or open mouth the discharges from a horse's nose or mouth, as after the act of sneezing, snorting, coughing, etc. Exceptional cases have been recorded from drinking from the same pail used in watering horses, or from the common use of a handkerchief. The bacillus may also be lifted into the air and disseminated in the vicinity of the animal, especially in close apartments, stables, etc., whence it may be inhaled into the respiratory tract of man. The disease has attacked and exterminated an entire family, man, wife, and four children, from the use of the same dish. Glanders occurs in the great majority of cases among hostlers, coachmen, drivers, stock-farmers, veterinary surgeons, butchers—that is, individuals who come in closest contact with the horse—and is, of course, much more common in the male sex. Bollinger found but six females in one hundred

and twenty cases, and then in the case of women compelled to substitute men in the care of horses. For the same reason children are almost exempt from the disease. Man is much less susceptible to glanders than the soliped.

The period of *incubation* after inoculation or inspiration varies from three to five days. It may extend to three weeks.

Symptoms.—The disease manifests itself at the point of inoculation with *redness, swelling, and pain,* with speedy *affection of the neighboring lymphatics.* Constitutional signs occur in the course of a few days. They may even precede apparent changes in the wound. *Chilly sensations with fever* are attended with *headache and prostration. Vague rheumatic pains,* more especially in the

FIG. 85.—Farcy buds in the skin.

neighborhood of the joints, with local symptoms in the skin, may more distinctly announce the infection. Where or while the local symptoms or the cutaneous signs are still absent, the disease *simulates typhoid fever,* for which it has often been mistaken. The character of the disease is, however, soon made manifest by the appearance of *hard, red nodules,* varying in size from a pea to a walnut, much resembling the eruption of small-pox. These nodules soon show softening of the centre and become converted into *pustules, which burst,* to give vent to thick, fetid pus. The nodules may increase to such magnitude as to form tumors—the so-called *farcy buds*—or, in the process of suppuration, constitute abscesses, the rupture of which leaves ulcers. These ulcers may destroy tissue to such depth as to expose tendons and bones. The process may extend

rapidly in twenty-four to forty-eight hours, or more slowly, to persist for three or four weeks.

It is a fact, to be explained, perhaps, by the difference in the rôle of the nose in respiration, that while the manifestations in the skin are much less frequent and severe in the horse, symptoms on the part of the nose assuming in this animal so much greater prominence, the converse is true of man. Glanders in the nose is less frequent and severe in man than in the horse. Hauff declares that in more than half the cases in man the nose is not at all affected. Occurring in man, it shows the same symptoms as in the horse. The secretions, which may come only from the affected side, soon become changed, and the discharge from the nose shows the same thick, purulent, fetid matter as in the case of the horse. There may be usually seen at a glance, on inspection, such swelling and redness of the nose and

Fig. 86.—Tubercular glanders in the nose.

face as at times to *simulate erysipelas*. Sometimes tubercles may be discovered upon the alæ of the nose. As in the horse, the affection of the nose may show itself later in the course of the disease, often in the second or third week. The mucous membrane of the eye, mouth, fauces, and of the whole respiratory tract may subsequently become involved. The appearance of the membrane, with the tendency to hæmorrhage, fetor oris, and dysphagia, may much *resemble scurvy*. There may be always observed in these cases the same involvement of the glands. The submaxillary and sublingual glands may suppurate to discharge externally.

Affection of the bronchial mucous membrane is evidenced by harassing *cough*, with the profuse *expectoration* of the same *fetid matter* and the subsequent development of *dyspnœa*. Fever may be entirely absent, or may, in an individual case, assume prominence,

with a temperature at 106°, and a feeble, irregular pulse like that of pyæmia.

The *chronic* distinguishes itself from the acute form by its less intense manifestations and more protracted course. The affection of the nose, when present, does not vary in any essential from that already described. It is, however, less frequently present in man than in the acute form of the disease. There is the same purulent discharge with its excessive fœtor, the same swelling of the whole structure, while the nares are blocked with offensive crusts. Peculiar repulsiveness is added to individual cases in gangrenous changes which may occur at the root of the nose. The manifestations in the skin are much more common, and upon these the diagnosis is, for the most part, established. Nodular masses may form anywhere over the body, more especially upon the extremities, to discharge sanguineous serum and pus. Sometimes the

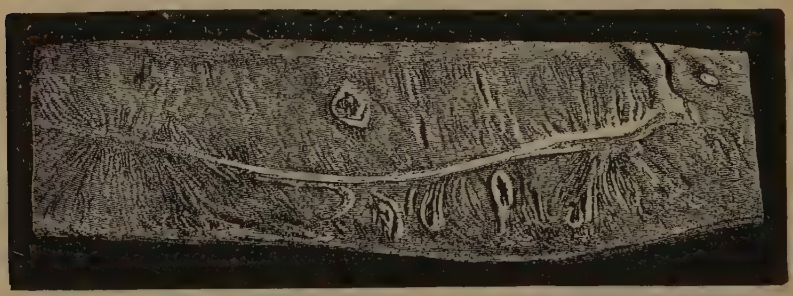


Fig. 87.—Discharging cicatrices in the nose.

affection is more superficial and shows itself in the form of blebs, which may simulate small-pox, chicken-pox, or pemphigus.

The various complications of pyæmia may subsequently ensue. Arthritis, serous or suppurative inflammations of the various serous membranes, with exudations, suppurating nodules, and masses in the muscles and bones, followed by extensive destruction of muscle and necrosis of bone, with deep erosions in the mucosæ and subcutaneous tissues, are common phenomena of marked cases.

These various complications may follow each other rapidly in acute cases. The blood is quickly poisoned and the patient succumbs in the course of a week ; in the more subacute cases, in two to four weeks, with delirium and coma. The disease is much more protracted in chronic cases. It may last for several weeks, months, even years, and finally cause death by marasmus. There is during all this time constant liability to the development of the acute form with its more rapidly fatal consequences.

The *diagnosis* is made to rest upon the nature of the avocation and the possibility of exposure. It is further determined by the two signs which have given names to the disease—to wit, the glanders, which finds its analogue in man in the term ozæna. It is to be remembered, however, that ozæna applies also to fetid discharges from the nose from various other causes, notably from syphilis. The second factor is the farcy, the nodular eruptions, abscesses, and ulcers found in the skin. The disease is recognized in its constitutional form by the signs of pyæmia—that is, by the chills, fever, and sweats, hebetude, delirium, and coma, together with the various metastatic depots.

Syphilis may be separated in a doubtful case, *ex juvantibus*, as iodine and mercury have no effect upon glanders.

Tuberculosis shows, as a rule, predominating signs on the part of the lungs ; and while it may affect the bones, as in a case of glanders, tuberculosis distinguishes itself by sparing the nose and skin, organs of selection in glanders. Small-pox is more uniform. The pustules of glanders appear in successive crops and rapidly ulcerate (Liveing). Pyæmia usually results from a single centre or depot, which may be recognized or discovered. Cryptogenetic cases may be distinguished at times only by the discovery of the specific micro-organism of glanders.

The diagnosis of glanders really rests absolutely upon the recognition of the Bacillus mallei. Travers, long before the discovery of the specific micro-organism, established the diagnosis in doubtful cases by inoculation of goats and rabbits with matter discharged from some of the ulcers. Bollinger recognized the disease in the same way by the inoculation of a horse. The inoculated animals showed the special lesions and succumbed in the course of two or three months. Cornil succeeded in inoculating two of fifteen guinea-pigs by rubbing cultures into the intact skin of guinea-pigs. Washbourn and Schwartznecker established a diagnosis of human glanders by the isolation of the micro-organism, its cultivation, and the inoculation of animals. Jakowski called attention to the affection of the testicle that occurs in these cases, and Strauss adopted the method of intraperitoneal injection as the quickest means of absolutely identifying the disease by implication of this organ. He was led to adopt this method on account of the difficulties attending the inoculation of animals with the products of the disease. Subcutaneous injections in dogs do not always give definite results, and the inoculation of less susceptible animals—*e.g.*, guinea-pigs—is unsatisfactory because of the length of time before death, twenty-five to thirty days. Field mice and marmots succumb in two to five days, but these animals are often difficult of access.

After the intraperitoneal injection of the discharges of glanders into the bodies of male guinea-pigs, there is observed first, as a prominent lesion, *affection of the testicle* as early as the second to the third day. The scrotum becomes tense, red, and shining, the epidermis desquamates. Suppuration speedily occurs, to perforate the integument, and in the pus is to be found the Bacillus mallei. The animal succumbs somewhere between four and fifteen days. The complication results also under subcutaneous injection, but much later—ten to twelve days. Löffler showed that it was not only the tunica vaginalis but also the parenchyma itself which showed nodules of the disease. The tunica vaginalis is covered with granulations, and by the third to the fourth day its layers are agglomerated by an exudation of pus rich with bacilli. A means of diagnosis is also offered with the injection of malleïn (Preusse), which, as in the case of tuberculin in tuberculosis, produces a peculiar febrile reaction in glanders.

The *prognosis* in a case of acute glanders is absolutely unfavorable. The only possible rescue may result from the speedy destruction and thorough annihilation of the first infection. Nearly all the acute and more than half of the chronic cases succumb to the disease.

Prophylaxis.—Animals affected with glanders are to be isolated and killed. According to the report of the Berlin Health Office, 1890, there were reported as affected with glanders thirteen hundred and thirty-seven horses. Eighty died ; ninety-three were killed at the request of their owners ; fifteen hundred and ninety-eight animals were destroyed by the police—in all seventeen hundred and seventy-one horses perished. For those killed by the police there was paid by the State 459,834.08 marks indemnity.

The cadaver is to be cremated or buried deep. Litter and fodder are to be likewise burned and stables thoroughly disinfected. All persons who have come in contact with infected horses should be warned of their danger.

Treatment.—Local depots are to be treated thoroughly and promptly by the application of the actual cautery, strong carbolic acid, mineral acids, and corrosive sublimate, as in the treatment of anthrax. Chronic cases are to be supported with quinine, arsenic (Gamgee), and alcohol.

HYDROPHOBIA.

Hydrophobia (*ὕδωρ*, water, *φόβος*, fear) ; Greek, *λύσσα*, rage ; Latin, *rabies ;* French, *la rage ;* German, *Wuth, Tollwuth, Hundswuth ;* Italian, *rabbia ;* Swedish, *Hundsjuka.*—An intensely virulent infection of lower animals—dog, fox, wolf, cat, and skunk—in the order of decreasing frequency, communicable also to any ani-

mal (herbivora, fowl) and to man ; with the most variable, often the longest known period of incubation ; distinguished by melancholia, terror, intense hyperæsthesia of the medulla ; evinced as a spasm of the pharynx and larynx excited by attempts to swallow, or the presence or the mere thought of liquids, a subsequent very short stage of paralysis, and almost inevitable death.

The name is appropriate as expressing the most prominent symptom of the disease in man, but is inappropriate for the lower animals, as precisely this symptom, the fear of water, so obtrusive in man, is in them entirely absent.

History.—It is strange that while the disease appears to have been known to the ancient Indians, Egyptians, and Israelites, Hippocrates makes no mention of it. Aristotle (322 B.C.) recognized it unmistakably in dogs : " Dogs suffer from rabies. This induces a state of madness, and all animals who are then bitten by them are likewise attacked by rabies." Democritus considered it an inflammation of the nerves allied to tetanus. It is mentioned by Virgil, Horace, Ovid, Plutarch. Celsus, who first uses the word, speaks of it as the disease which *ὕδωρφοβίαν Græci appellant.*

The thorough elaboration of symptomatology in the lower animals as well as in man is chiefly due to English observers, especially to Youatt. Pasteur has connected his name with hydrophobia for all time, with his studies of prophylaxis—studies which established the nature of the disease as an infection whose symptoms are due to toxines from some as yet undiscovered micro-organism, and which fixed the fact of the first importance that rabies may in no case arise spontaneously, but always and only from itself.

Etiology.—Hydrophobia, like syphilis, is communicated by inoculation through a broken skin ; and while it may be transmitted by any animal, it is actually communicated to man, in the great majority of cases (ninety per cent), by the bites of rabid dogs.

The period of incubation in the dog varies usually from twenty to fifty days. It may vary from six to two hundred and forty days. *It is certain that the animal may communicate the disease during the whole of the period of incubation.*

Escape may be due to accident. A bite after a recent bite is less dangerous. Saliva may have been wiped off in the first bite or on the garments. The danger is illustrated by the part of the body bitten. In some American statistics quoted by Watson, of seventy-five cases the wound was in the hand forty times, on the face fifteen, in the leg eleven, and the arm nine times. Of four hundred and ninety-five cases collected by Bollinger, fifty-three per cent were bitten on the upper extremities, twenty-two per cent on the head and face, twenty-two per cent on the feet, and three per cent on the body and scrotum.

The cures of the charlatans by so-called madstones, etc., often of great virtue in psychical cases, get their reputation from use in cases which have escaped real infection.

Incubation.—The period of incubation of hydrophobia covers a point of the most intense and anxious interest. How long after a bite may an individual be considered safe? This is the point in which hydrophobia differs from all known diseases, in that the period of incubation is so indefinite. In the majority of cases it is unusually long. Thus in sixty per cent the period of incubation varies from eighteen to sixty days, but in thirty-four per cent—that is, in a little over one-third of all the cases—the period is longer than two months. Cases are abundantly upon record of outbreak of the disease only after the lapse of three to six months, and there are cases upon authentic record where the only exposure which could have accounted for the disease occurred one or even more than two years before the attack. In a very small ratio of cases (six to eighteen per cent) the period of incubation is short, from three to eighteen days. Sometimes these alleged long periods, as well as cases without apparent cause, find explanation in a more recent infection which has been overlooked or forgotten.

Variation in the time of outbreak has been distinctly observed in dogs. On one occasion six dogs bitten by one rabid animal showed signs of the disease respectively in twenty-three, fifty-six, sixty-seven, eighty-eight, one hundred and fifty-five, and one hundred and eighty-three days.

From almost the first recognition of the disease in man attempts have been made from time to time to deny its existence altogether, and to consider hydrophobia a fright or a form of hysteria or of tetanus. The fact, however, to say nothing of inoculation experiments in animals, that so many children under the age of five (nine per cent), and so many idiots and imbeciles, in whom the imagination could play no rôle, have succumbed to the disease, sufficiently disproves this view. The symptoms, as will be seen, distinctly differ from tetanus; and the most that may be said of the hysterical origin is the fact that hysteria may simulate hydrophobia or any other disease.

Notwithstanding the searching investigations at the hands of the best observers, especially in connection with the study of prophylaxis, the cause of hydrophobia remains unknown. The analyses of chemistry have failed to disclose it. No specific micro-organism has been detected in the saliva or other fluid, and no distinct toxine has been eliminated from any of the secretions or tissues of the body. The poison is in all cases fixed, never volatile. It is produced only within the body, never outside of it. It acts in every respect like a chemical poison which is evolved from micro-organisms, but differs

from all the known poisons by the length of time in which it may remain innocuous in the body. Other secretions than the saliva, as well as the flesh of animals, as a rule fail to convey the disease.

Various theories have been proposed to account for the long latency of the disease. The latest assumes that the poison lies latent at the wound, and from it chemical products are occasionally introduced into the blood, but are neutralized from time to time by the serum of the healthy blood, by the so-called protective proteids which act as antitoxines or antidotes, until finally they fail, to permit intoxication. This view has now the best support. It accounts for the escape of so many cases with the simultaneous infection of others. It furnishes an explanation of the fact that the bite of a dog in the stage of incubation may be, but is not always, infectious. It accounts also for the favorable influence even to the prevention of the disease by the destruction of it at its origin. It allies it with other poisons, as in a case of septicæmia, where the removal of a local depot may put a stop to a long train of septic signs.

Morbid Anatomy.—The only changes which can be said to be at all characteristic are microscopic, and they are, with the rest, sometimes entirely absent. The small vessels are dilated, and invested upon their exterior with leucocytes, which invade also the circumjacent tissues. These changes are most marked in the medulla and the upper part of the spinal cord, as well as in the cerebral cortex, whence the symptoms of hydrophobia arise. Gowers observed this condition in seven of nine cases. Emigration or accumulation of leucocytes is at times so great as to fill up the whole space within the lymphatic sheath. These escaped and accumulated cells constitute what may be called miliary abscesses. In association with them are observed at times small hæmorrhages, seldom large enough to be visible to the naked eye. This perivascular accumulation of leucocytes, especially in connection with the vessels of the medulla and cortex, constitutes the most constant and characteristic lesion of hydrophobia. Unfortunately, as stated, this sign, with all the rest, is sometimes entirely absent.

Symptoms.—Hydrophobia is divided into three stages: the psychical, spasmodic, and paralytic. The disease is exceptionally announced by changes at the seat of the wound, which, as a rule, has long since healed. The wound may open anew or become the seat of pain, itching, numbness, or other paræsthesia. Sometimes pain irradiates from it in various directions. Sometimes the first feeling is in the nose or throat—a sneezing, a *dryness or rawness*, which is considered "a cold."

A peculiar state of *depression and irritability* soon sets in, sometimes suddenly with *headache, anorexia, insomnia, anxiety.*

Mental symptoms assume prominence according to the temperament of the individual. A man may deny the fact that he ever was bitten by a dog, while he is unable to divert his mind from the actual occurrence and the terrible consequences which are liable to ensue. The inquiry or suggestion of a thoughtless, meddlesome, or inquisitive neighbor will plunge the strongest man into *melancholy or mania*. The mental distress is, however, always an exaggeration of a state of apprehension, of a sense of impending danger or imminent death; and though a man may show, under the stress of this suffering, signs of insanity, there is no time when he may not be recalled to himself by a right address. A patient affected with the first stage of hydrophobia presents a pitiful picture. He sits quiet, apparently listless, his whole mind intensely concentrated upon the one thought from which no appeal or address may really divert him. It is only in the very first hours of the attack that he may find relief in walking about or in change of scene. He soon becomes exhausted, and sits with an expression of intense anxiety to which he makes total surrender. At the same time the special senses are keenly alert, so that a flare of light, a draught of air, a noise, may produce intense excitement. The very first day shows the characteristic sign of the disease—the *fear of water*. The patient suffers with thirst, but is unable to allay it. He may make the attempt, may succeed at first in swallowing a mouthful or two, but soon abandons it, either on account of the intense suffering which ensues, or from the fear of its certain following. An unmistakable sign of the disease is the occurrence of burning, more especially a sense of tightness or constriction, of the larynx. The fear of water is the fear of exciting spasm of the larynx, and the reflex excitability of the larynx becomes so intense that spasm is later precipitated by the sight, the sound, or the mere thought of water, even by the mere sight or touch of a smooth or cold surface. A coachman under Watson's observation had to desist from sponging himself, according to his habit, with cold water, though he said he "could not think how he could be so silly." Frequent *sighing* is a common sign at the inception of the disease.

The first stage usually lasts about twenty-four hours, when the second stage, *the spasmodic or true hydrophobic stage*, sets in. This stage is characterized by an exaggeration or an intensification of the *spasmodic contraction of the larynx*. Every attempt to swallow is attended with frightful anxiety. The contraction is so powerful as to lead to *dyspnœa with maniacal excitement*. The patient may strike about in every direction, roll his head from side to side, while the mouth opens and closes convulsively, sometimes with snapping sounds, whereby wounds are occasionally inflicted

upon ministering hands ; and the disease has actually been conveyed in this way. These convulsive seizures gave rise to the stories that hydrophobic patients bite and snap like dogs, and led, through the fear which they excited, to the cowardly assassination of patients by shooting them down—a practice still in vogue on the confines of Austria—or by smothering them between feather beds. The paroxysms seem all the more dreadful because they are attended with the escape of glutinous, foaming saliva, which is sometimes ejected with great force in every direction. Inspiration is also attended with gaping and sighing and various sounds, sometimes simulating the bark and howl of dogs. These things occur in paroxysms, in the interval of which the mind is clear, though sometimes, in highly nervous temperaments, it may be excited to show more persistent hallucination. The pulse is quickened and rendered irregular, but with all the struggle there is, as a rule, but little elevation of temperature. The employment of any forcible measures of restraint aggravates the explosion.

The second stage lasts, as a rule, from one to three days, rarely as long as four days. The patient now becomes gradually exhausted. Paroxysms occur, but they are less intense. The extreme anxiety of mind is diminished; there are intervals of nearly complete tranquillity. It is plain to see, however, that while the breathing is easier and the explosions less severe—there may be even ability to swallow —the patient becomes more and more prostrated and reduced. The strong man is broken. The heart's action is weak, the pulse flutters, the surface is covered with a cold sweat. The movements of the body are so much enfeebled as to present the *appearance of paralysis ;* hence this third stage has been characterized as the *stadium paralyticum.* Death, which may occur suddenly in a convulsion or from asphyxia, usually does occur quietly from failure of the heart.

Hydrophobia is an exquisitely acute infection. However long the period of incubation, the whole duration of the disease proper is measured in a few days. Eighty-two per cent of cases perish in from two to four days. Individual cases may succumb in two or may last as long as five or six days.

The *diagnosis* is generally easy, and rests chiefly upon the heightened reflex of the medulla, as manifested in spasm of the muscles of deglutition and respiration.

The disease is differentiated from tetanus by its much longer period of incubation. Tetanus occurs in from three to ten days after the wound or injury. Tetanus usually begins with trismus, and is often attended with opisthotonos. It lacks the laryngeal symptoms and spasms of hydrophobia. It lacks also the psychical exaltation

and mental anguish of hydrophobia. Tetanus may also be distinguished by its special micro-organism.

The disease is often distinguished with great difficulty from the imaginary condition known as LYSSOPHOBIA, or fear of hydrophobia. These cases have a common origin, though in the one case the wound comes from a non-affected animal. It might be imagined that lyssophobia occurred more frequently in nervous subjects or in women. This is not the case. The strongest men have suffered, and not infrequently actually succumbed to fright or fear of hydrophobia. Some of these cases have been rescued by knowledge of the fact that the animal was not rabid ; hence the advisability, when possible, of secluding the animal, that the existence or course of its disease may be observed. The fact that the animal recovers at all almost necessarily excludes hydrophobia. Abundant cases are recorded where information of the recovery of the animal, or the sight of the animal itself, has allayed the most intense nervous symptoms.

The *prognosis* is fatal. It is commonly said that the physician that cures is death. Bollinger goes so far as to say that the cases of alleged recovery may be invariably found to be due to some other disease, or to the fact that the animal was not rabid. Yet it must be admitted that dogs have recovered from the disease. Law mentions eight such cases, two of which were attested by successful inoculation of other animals. The possibility of spontaneous recovery may therefore be entertained in man. Wounds on the face are, as stated, always the most serious. Bouley declares that ninety per cent of these cases are followed by hydrophobia, whereas the mortality from wounds of the hands is sixty-three per cent, of the lower extremities twenty-eight, and of the upper extremities twenty per cent. Many cases are certainly rescued by prompt treatment. Bollinger quotes in proof the following statistics in France : Of two hundred human beings bitten by rabid animals, one hundred and thirty-four were cauterized. Of these, ninety-two (that is, sixty-nine per cent) remained healthy, while forty-two (that is, thirty-one per cent) died of hydrophobia. Of those not cauterized, eighty-three per cent succumbed to the disease. In one case sixteen persons and one ass were bitten by the same animal. The human beings were cauterized and rescued without exception ; the ass, which received no treatment, died of the disease.

The only true *prophylaxis* is the muzzle, which renders all other prophylaxis superfluous. But for various reasons, including a kind of sentimentality, the process of muzzling had never been rigidly enforced outside of a military country like Prussia. The disease, which was formerly common in Prussia, was actually extinguished, as stated, for nine years by the rigid enforcement of universal muzzling. Hol-

land secured nearly the same exemption in the same way. The number of dogs may be limited by being subject to higher taxation. Every dog should have a known master. Suspected dogs must be carefully confined, and for as long a period as six months. Dogs imported from countries of lax laws in this regard should be quarantined for six months. Actually rabid dogs or other animals that need not be preserved to determine the condition of human beings or other animals attacked, should be killed at once. Filing the teeth, or attachment of blocks of wood about the neck, confinement by chains, attempted prophylaxis by injection of virus, are all means too unreliable for practice.

Treatment consists in the destruction or elimination of the poison in the wound. Absorption should be first prevented where practicable, as on the extremities, by a ligature above the wound. A piece of cord or handkerchief should be firmly twisted about the limb with a piece of wood. Where it may be done, the patient should withdraw the poison from the wound by suction. With proper precautions this act may be substituted by another person. The act of suction is, however, dangerous in cases of carious teeth, or wounds in the gum, cheek, or other parts of the mouth. The operation may be done, nevertheless, if the individual take the precaution to rinse the mouth thoroughly, after every suction, with carbolic acid. Hertwig found that the virus of hydrophobia applied to the mucous membrane of the mouth and digestive tract was entirely innocuous. This process, which has been resorted to from the most ancient times, has never yet proven infectious. In the first decades of the present century, in Lyons, certain women—*Hundsäugnerinnen*—pursued this business as an avocation. They received ten francs for the first, and five for each succeeding suck. On the surface of the trunk and some parts of the face the poison may be exhausted by cups. Immediately after suction the wound should be cauterized. Youatt relied entirely upon such a superficial caustic as the nitrate of silver. As he was himself bitten seven times, and operated on four hundred persons, only one of whom died, and that one, as he declared, from fright, this caustic may be considered sufficiently strong if applied immediately. Caustic potash burns deeper. The actual cautery, as from a poker, a nail, the galvano-cautery, brought to a white heat, would certainly destroy the poison more effectually. Where wounds are very extensive or numerous the effect may be best accomplished with stronger solutions, 1 : 500 or 1 : 1000, of corrosive sublimate. Extensive laceration of extremities may require amputation.

Psychical treatment is of supreme importance. Romberg first advised the necessity, on the part of the attendants and friends, "to preserve a calm demeanor, to avoid all allusion to the previous in-

jury, and to appear cheerful." To secure diversion without effort or remark is an essential factor in the relief of suffering, at least. The intense reflex excitability of the medulla is best met by seclusion in a quiet and rather dark room. The exhibition of cases as curiosities, or as objects of morbid sympathy, is a cruelty, if not a crime. Frequent warm baths, where at all permissible, as at the very start, tend to allay excitability and spasm. Very soon, however, resort must be had to anodynes and anæsthetics. Violent cases may require the use of chloroform. The same object may be at first obtained with chloral. The various remedies recommended as specifics—curare, calabar bean, pilocarpine—have proven useless, except in allaying spasms. The use of animal poisons has proven equally futile. Watson speaks of cases treated with the virus of snake bites. One man was bitten by nine vipers without effect. Opium is the best shield. Sooner or later resort must be had to morphia in the later course of the disease, preferably subcutaneously, with a view at least to secure euthanasia.

With this history hitherto, it may be appreciated with what acclamation was hailed the claim by Pasteur of the discovery of a means of preventing the disease by the use of attenuated virus. It had been always known that the disease expends its main force upon the medulla. Whatever lesions are encountered in the disease are seen here.

So soon as Pasteur had determined that the virus of hydrophobia comes to be located in the central nervous system, especially in the spinal cord, he began his experiments with this substance to secure attenuated matter. He found that a continued inoculation of the virus from rabbit to rabbit increased its virulence to such degree that after about twenty-five generations he got a virus which showed its effect after an incubation of but eight days. In twenty-five generations further the period of incubation was limited to seven days. This virus was taken as a so-called *virus fixe*, as a basis substance for protective inoculation. Pasteur discovered that desiccation of the medulla from such an animal in sterilized glass vessels in which had been put pieces of caustic potash brought about a gradual reduction of virulence. The medulla became less and less poisonous. The drying process was continued, until, after two weeks' desiccation, it was entirely innocuous. Injections were now made with an emulsion of the non-virulent medulla, and were followed up with emulsions of medullæ of increasing violence up to those which had been dried but one or two days. Dogs so treated were immune to infection with fresh hydrophobic matter.

In the treatment of the hydrophobia of man, Pasteur began with weaker preparations—to wit, with the medulla of the rabbit after

fourteen days' desiccation, and increased on the following days up to that of the fifth day, whereby immunity or protection was secured. The attempt to use stronger preparations in a shorter time, in protection against the more dangerous and extensive laceration of wolf bites, had to be discontinued. This treatment has been used now in thousands of cases ; and while it cannot be said to have furnished perfect results, as a number of cases thus treated have nevertheless succumbed to the disease, it must be admitted that the majority of cases thus treated have been rescued from the horrors of hydrophobia. The statistics of the Pasteur Institute from 1886 to 1891 show a continued decrease of deaths from 0.94 per cent in 1886 to 0.25 per cent in 1891. In 1891 as many as 1,464 patients passed under treatment.

These results, brilliant as they are, are eclipsed by the report of Tizzoni and Centanni, who make the extraordinary claim to be able not only to confer immunity, but to actually cure hydrophobia, even after the disease has developed, by the injection of the blood serum of animals rendered immune to the disease. The immunity is conferred by the inoculation of an emulsion of spinal cords (rabbits) attenuated by partial digestion in artificial gastric juice (peptones). Poppi finds that the matter used by Pasteur may be further attenuated, by dilution and heat, to act not only like a veritable vaccine in protection against the disease, but also to cure it. These claims have not yet been conclusively established.

TETANUS.

Tetanus (*τετανός*, *τείνω*, to stretch) ; trismus, lockjaw, opisthotonos (*ὄπισθε*, backward, *τείνω*, to stretch) ; German, *Wundstarrkrampf*.—A grave, often exquisitely acute infection, caused by the tetanus bacillus, introduced through a wound or some break of the surface ; characterized by excessively heightened reflex under the action of toxines which induce spasmodic contraction of the voluntary muscles, first and especially, of the jaw (trismus, lockjaw), face, and neck, and extensors of the spine (opisthotonos); of short duration, often of rapidly fatal termination. Among the larger animals the horse, sheep, and goat are especially liable to the disease.

History.—The clinical features of tetanus are so coarse and obtrusive as to have been remarked in the most ancient times. Some of the finest descriptions of Aretæus were based upon observations of tetanus. "In all the varieties," he says, "there is pain and tension of the tendons and spine, and of the muscles connected with the jaws and cheek, so that the jaws could not easily be separated, even with levers or a wedge." Hippocrates devoted a whole section to its treatment, and certainly appreciated the gravity of the disease.

"Such persons," he says, "as are seized with tetanus die within four days, or if they pass these they recover."

Most of the contributions of later times have been presented by the surgeons, Laurent, Larrey, etc. Curling wrote his famous "Treatise on Tetanus" (Jacksonian prize essay) in 1834; Rose (E.) made the most valuable clinical contribution of modern times to the "Handbuch der allgemeinen und speciellen Chirurgie" (Pitha und Billroth, Bd. i., Abtheil. A, 1870). Nicolaier discovered the bacillus of tetanus in the soil in 1885. Rosenbach demonstrated it in man in 1886. Gagliardi reported the first cure of tetanus in man by the subcutaneous injection of the antitoxine of Tizzoni-Centanni in 1892.

Etiology.—Tetanus may occur in consequence of any kind of wound, but does occur much more frequently after contused wounds with penetration of foreign bodies. It is, therefore, frequent after gunshot wounds, and is especially frequent in wounds of the extremities. Wounds of nerves are also attended with special liability. Tetanus may follow a lesion as trivial as the extraction of a tooth, a venesection, the sting of an insect, a simple scratch of the surface, the application of a blister, a slight wound of the foot, as from a nail in a shoe. It occurs not infrequently in the new-born from lesions of the umbilical cord, and has been repeatedly observed after a wound of the cervix uteri, as after parturition. The intrusion of a splinter of wood, the lodgment of a fish bone in the throat, have broken the surface sufficiently to introduce or give entrance to the cause of the disease; and as the cause comes from without, tetanus occurs, in the great majority of cases, in wounds of the extremities. Curling found one hundred and eleven of one hundred and twenty-eight cases on the extremities, and Thamhaym, in three hundred and ninety-five cases, found the locality of the injury in the hand and finger one hundred and nineteen times.

Tetanus is a rare disease. Rose states that the mortality of tetanus in Berlin was but 0.04 per cent, and this included two hundred and sixty-six cases in new-born infants.

The disease is most frequent in hot countries. Aside from attack of the new-born, the period of greatest liability is between ten and thirty.

The tetanus bacillus is a delicate rod, a little longer than the bacillus of mouse septicæmia. It occurs in irregular masses in the affected tissue, and is recognized by the characteristic development of its spores. One end of the bacillus swells to show an oval, sharply defined, shining spore, and present the appearance of clock-bell strikers, drumsticks, or, better, pins. This spore formation occurs in great abundance in the body of the animal, as well as in artificial cultures. The bacilli are easily colored with methyl blue

and fuchsin. Artificial culture is difficult. The bacillus is strictly, *i.e.*, an obligate anaërobe, so that in artificial culture particles of infected matter must be introduced into the deeper layers of blood serum to secure growth. The culture is so commonly contaminated as to require often subsequent separation to obtain it pure.

Brieger (1887) obtained from sterilized cultures of the tetanus bacillus a toxine, which in mice, in the smallest doses, produced the typical symptoms of trismus and tetanus, with fatal termination. Besides this body, Brieger eliminated various toxalbumins with specific properties.

The bacilli and spores of tetanus are so widely disseminated in soil and dust as to be almost ubiquitous. They abound most on the surface of inhabited soil, and are not entirely absent in uncontaminated virgin soil. The rubbish and dust of streets and houses are soils of predilection. The wide dissemination of the parasite accounts for the cases of apparent spontaneous or idiopathic tetanus, while the fact that the free access of oxygen prevents its growth furnishes explanation of the comparative rarity of the disease and the greater liability of penetrating wounds.

Fig. 88.—Bacillus of tetanus.

The period of incubation varies from one to two weeks.

Symptoms.—The disease begins, as a rule, with *spasm of the muscles of mastication.* Contraction of the masseters locks the jaws, to produce the condition known as *trismus*, lockjaw. Contraction of the muscles of the neck occurs at the same time, or may precede the contraction of the jaws. Rose declares that the contraction of the masseters may be felt by the insertion of the finger within the mouth, and that the stiffness of the muscles of the back of the neck is best recognized, as in cerebro-spinal meningitis, by attempts to lift the body by the head. The affection of the muscles of the face soon produces a *peculiar physiognomy.* The lips are usually stretched over the closed teeth, to produce the characteristic smile, the *risus sardonicus*, so graphically described by Hippocrates. Fagge speaks of the case of a girl who was reprimanded by her mother on account of a singular grinning expression of the face, over which she had, of course, no control. This alteration of the physiognomy gives to the patient the appearance of age. Farr says a man aged

twenty-six was taken for sixty. The disease *begins usually mildly*, and increases gradually and progressively. There is in association with the stiffness of the neck or diminished mobility of the jaw some *difficulty of deglutition.* The muscles are affected from *above downward.*

The spasm extends to involve the *muscles of the back.* Implication of the groups of great muscles in the spine soon distorts the body. The whole trunk is stiffened like a statue (orthotonos), or is more frequently arched, with its convexity upward, so that the body may rest upon the back of the head and the heels—*opisthotonos.* The forearms and hands are spared for a long time. Motion, either active or passive, is soon inhibited or lost altogether under the board-like indurations of the muscles. During these states of rigidity *convulsive attacks* occur with shocks like strokes of lightning. They show themselves in consequence of effort, even of involuntary effort, or as the result of any outside irritation, and express the intense reflex excitability of the spinal cord. In the interval the body assumes the position of rigidity from which it has been distorted by the violence of the spasm. The suffering of the patient at this time is indescribable. The spasms are attended with *excruciating pain.* The mind is perfectly clear, but is weak from loss of sleep and anxiety. The patient may not satisfy either hunger or thirst, on account of locking of the jaws. The opisthotonos prevents a proper decubitus. Individual muscles, especially the recti abdominis, have actually ruptured under the powerful contraction, to discharge masses of blood at their divided ends. *Difficulty of breathing, cyanosis,* a sense of distress and danger, with lancinating pains at the bottom of the chest, indicate the spasmodic contraction of the diaphragm. Fever may be entirely absent. There is generally some elevation of temperature, which is liable to sudden exaggeration, often without discoverable cause, probably due to the influence of the nervous system. Extreme elevations of temperature to 110° or 112° are pre-agonal. Sometimes there is an elevation of temperature post mortem. The skin is usually covered with *sweat*—a point often of diagnostic value. The bowels are constipated. There is often suppression and more frequently retention of urine.

The *diagnosis* largely rests upon the early appearance of trismus. Lockjaw from sore throat, mumps, synovitis, rheumatism at the temporo-maxillary articulation, should be easily distinguished by the most superficial examination. The feel of the rigid masseters inside the mouth, and the associate stiffness at the back of the neck, speedily dissipate doubts. Hysteria and hystero-epilepsy may show the typical opisthotonos of tetanus, but hysteria is, as a rule, unattended with trismus; and when trismus is simulated by the fixation of the

jaws, hysteria is recognized by the fact that the intervals of attack are irregular and always entirely free from spasm or pain.

The regular invasion of tetanus from above downward, first of the muscles of the face and neck, later of the trunk, distinguishes the disease from the spasmodic contractions of spastic myelitis. Cerebro-spinal and basilar meningitis, which have, in common with tetanus, stiffness of the neck and opisthotonos, almost never show trismus. They have also a different origin and history—*i.e.*, epidemic, tuberculous—with associated symptoms, vomiting, headache, hyperæsthesia, herpes, etc., not seen in tetanus.

Tetany is distinguished by its typical spasms of days' and sometimes weeks' duration, and absolute intermissions; by the peculiar contraction or position of the hand, which may be called out by long pressure upon the nerves or arteries of the arm—the so-called Trousseau phenomenon; by the frequent laryngo-spasm; and by the increased mechanical and galvanic excitability of the motor nerves.

Hydrophobia, which has, in common with tetanus, spasm of the muscles of deglutition, is distinguished by the much shorter period of incubation, by the trismus and opisthotonos of tetanus, and by the psychical exaltation and anxiety of hydrophobia.

By far the most important question in differential diagnosis concerns the recognition of poisoning by strychnia, which is most closely simulated by the effects of the toxines of tetanus. This diagnosis rests upon the following points: 1. The history of origin, where it may be obtained. 2. The existence of a wound. 3. The period of incubation. Signs of strychnia poison supervene at once. Tetanus begins with trismus and gradually descends, sparing, as a rule, except in children, the arms and hands; strychnia often shows its first signs in irritation of the stomach and in the affection of the muscles, seizes by preference upon the extremities. In tetanus there is persistent rigidity; in strychnia poisoning there are intervals of absolute relaxation. Thus, in the interval between the paroxysms the mouth remains closed in tetanus, but may be freely opened in strychnia. The reflex spasms of tetanus occur later in the course of the disease and increase in intensity, while those of strychnia occur at once, intense from the start. Strychnia poisoning is quickly terminated by death or recovery. Tetanus may be protracted into days and weeks. Golding-Bird reported the case of a boy affected with tetanus, with spasms for fifty-one days, with subsequent persistent rigidity, and death on the one hundred and seventh day.

Eiselsberg establishes, as a difference between tetanus and other wound infections, the fact that in tetanus local wound reactions are entirely absent. So-called cases of rheumatic tetanus are, therefore, really of traumatic origin.

The *prognosis* is exceedingly grave. Death may occur in any attack of convulsions. The heart has actually, under observation, suddenly ceased to beat. Death occurs, as a rule, before the end of the first week, so that, as Hippocrates said, "patients die within four days, or if they pass these they recover." In exceptional cases, however, the fatal termination may not occur for three weeks. The disease rarely lasts longer in childhood than two or three days. The prognosis is so grave in the new-born that, as Bauer declares, the occasional cases of recovery have been looked upon as being probably errors in diagnosis. According to Richter six hundred and thirty-one of seven hundred and seventeen military cases—*i.e.*, eighty-eight per cent—were fatal.

According to Rose sixty-three per cent of all cases die within the first five, and eighty-eight per cent within the first ten days. The relief of the later periods is probably to be explained by elimination of the toxines. Rigidity may persist for some time, even for months, after recovery. The ability to sleep is always a favorable sign.

Prophylaxis.—In prevention of tetanus it is to be emphasized that the minutest wounds soiled with earth, dust, or foreign bodies, as splinters, are to be scrupulously cleaned and disinfected. Patients themselves are to be isolated from other surgical cases.

In prophylaxis of the new-born it must be observed that the wound at the navel is attended with the utmost care. The aseptic treatment already recommended by various authors meets thus with scientific justification. For all the investigations concerning the origin of the tetanus bacillus demonstrate that it has an unusually wide ectogonous dissemination. Unclean hands, the use of bandages not sufficiently aseptic, and the raising of dust in the cleaning of the puerperal room, sufficed, in the observations of Beumer, to convey the infecting agent.

Treatment.—As in hydrophobia or other disease characterized by excessive hyperæsthesia of nerve centres, the patient should be kept perfectly quiet. He should be put in a dark room and isolated from curiosity or officious or meddlesome ministration. The most absolute silence should be enjoined, on the part of the patient as well as the attendants. On account of the locked jaw the food should be fluid, but should be as nutritious as possible. Milk, soft-boiled egg diluted with hot water, nutrient soups, stimulants, wine, whiskey, brandy, should be regularly administered. Where the act of deglutition excites spasm, the patient may be anæsthetized and, according to the suggestion of Rose, fed through a tube, which may be, as in the case of insane or refractory patients, inserted through the nose. Foreign bodies should certainly be immediately extracted, irritated nerve trunks excised. Angry wounds, "festering sores," may be

treated with the powerful antimycotics, carbolic acid, corrosive sublimate, or with the actual cautery. More extensive exsections, more especially amputations, are surgical barbarities of the past. Spasmodic contractions are best relieved by the administration of anodynes. Opium, on account of its associate discomfort and distress, is better substituted in our day by chloral. A large dose —one drachm at first—may be followed by smaller doses, fifteen to thirty grains, every hour or two, or as often as necessary to subdue spasm. Calabar bean and curare have been administered with success in individual cases, sometimes of questionable diagnosis; but these remedies have failed, as a rule, to secure other than temporary relief.

Bacelli recommended the injection of one centigramme of carbolic acid every hour or two until the spasms entirely ceased. Caliari claims to have cured a case in this way.

The hope of successful treatment lies in the use of the antitoxines derived from the blood serum of animals—dogs—rendered immune to the disease, or from the bodies of the bacteria themselves. Taruffi has already recorded a sixth case rescued in this way. The treatment consists in the injection of the tetanus antitoxine obtained from the blood of a dog rendered immune to the disease. Twenty-five centigrammes are injected twice a day. Such improvement occurs in the course of a week as to render the further use of the remedy unnecessary, and the treatment is usually concluded with the hydrate of chloral.

Unfortunately some of the best observers do not confirm these conclusions. Kitasato was not able to get immunity by tolerance, nor by the use of filtrates attenuated by heat. Rabbits were rendered immune in forty per cent of cases with the trichloride of iodine, but the immunity was lost in the course of two months. Immunity is conferred upon mice by the injection of the serum of immunized rabbits, but this immunity is lost in forty to fifty days. The fowl is by nature immune to tetanus, but the blood of the fowl does not confer immunity upon other animals.

By the second method Ehrlich, Brieger, and Wassermann utilize the antitoxines developed by the bodies of the bacteria themselves, after the manner of Koch with tuberculin. These antitoxines or protective bodies are to be obtained in the milk of parturient animals previously rendered immune in pregnancy by inoculation of an attenuated culture which is gradually increased in virulence. The protective principle remains in the whey after coagulation and separation of the casein, so that it may be preserved indefinitely. Some of the most sensitive of the lower animals—mice, goats, etc.—have already been protected in this way, but up to the time of the pre-

sent writing the accounts published of work with man have not been satisfactory.

WHOOPING COUGH.

Pertussis (*per*, intensive, *tussis*, cough) ; tussis convulsiva ; German, *Keuchhusten ;* French, *coqueluche* [used also for influenza] (from *coqueluchon,* a cape worn by patients).—An acute infection of childhood, distinguished by paroxysms of cough in rapid series, threatening suffocation, terminated by a long-drawn, audible (whoop) inspiration.

The name is derived from the fact that the cough is distinguished by a prolonged, forcible, and audible inspiration through a spasmodically contracted glottis. But many cases of whooping cough are without this characteristic sound, and, where different stages of the affection may be recognized, the sound is absent during the whole of the first and most of the last stage. The cough consists of a series of short, sharp explosions, spasmodic in their character ; a series of expiratory efforts without stop to catch the breath, until finally, after the lapse of from fifteen to sixty seconds, at the point of exhaustion occurs this prolonged, audible inspiration. It is the series of explosive coughs in quick and uninterrupted sequence, the short, sudden cough, the *staccato* cough, which marks whooping cough.

History.—The origin and home of whooping cough are involved in obscurity. According to Mason Good the disease was known to the Greeks ; but their descriptions, as well as those of subsequent writers, do not distinguish it, strange to say, from other spasmodic or catarrhal affections. All authors agree that the disease was certainly definitely described by Baillou (Paris, 1578), who spoke of it as a well-known malady.

Etiology.—Whooping cough is an infectious disease, because it is contagious and prevails as an endemic and epidemic ; because, also, of the absolute immunity which one attack confers. Rare as are second attacks of scarlet fever, measles, or small-pox, still more rare are second attacks of whooping cough. With the other infections it attacks preferably the age of childhood. Facts which have been taken to militate against the views of its infectious nature are absence of fever and indefiniteness of duration. Facts which refute the idea that pertussis is a neurosis are, first, origin and dissemination by contagion ; second, appearance as an epidemic ; third, immunity conferred by single attack. Neuroses belong to individuals and not to numbers. They show no relation to others and have constant tendency to recur. Proof of contagion is furnished by the attack of wet-nurses and nurses generally, instances of which are noticed in every epidemic.

The period of preference as regards age is from six months to six years. Sucklings, because of natural immunity, are rarely attacked. Susceptibility diminishes at six and is nearly annulled at ten years. Yet cases are on record where the disease has occurred in infancy and advanced life. From some inexplicable reason the female sex suffers most, in the proportion, according to nearly all authors, of five to four. The disease is not only more frequent but also more severe in girls. Measles, pregnancy, and the puerperium predispose to pertussis. The contagion is conveyed directly.

The contagious principle exists in the sputum, hardly possibly in expired air which contains no sputum. It is a contagium halituosum. The great botanist Linnæus, nearly two centuries ago, expressed the belief that whooping cough was due to a contagium animatum, which he thought would be found to be the eggs of insects. The principle is thoroughly accepted in our day.

Afanassièff succeeded in isolating from the sputum of whooping-cough patients a short, thick bacillus, which he cultivated upon beef peptone and agar. The bacillus differs in important particulars from forms hitherto described, and gives rise, when introduced into the trachea or lungs of dogs and rabbits, to symptoms simulating whooping cough and to lobular pneumonia. Ssemtchenko, after considerable experimentation, reached the conclusion that the bacillus of Afanassièff is specific. It may be found in the sputum as early as the fourth day of the disease. It multiplies in the body, and as it increases, the disease diminishes in severity. It disappears with the resolution of the disease, or when the paroxysms are reduced to two to four daily. In the presence of complications, especially catarrhal pneumonia, it increases in the sputum. Thus this bacillus is of value not only in etiology and diagnosis, but also in prognosis. These conclusions have, however, not yet met with universal acceptance, as the observations have not been sufficiently verified. Renewed interest attaches to this bacillus of Afanassièff with the discovery by Griffiths of a ptomaine or toxine in the urine of whooping-cough patients. Griffiths claims to have established the fact experimentally that an absolutely identical toxine is developed by this bacillus. The toxine is not found in any case of normal urine, nor in that of any other disease than pertussis.

There is now scarcely room for doubt that pertussis is a mycosis whose toxines have a special action upon that part of the nervous system which presides over cough—to wit, the centres of the superior laryngeal and vagus nerves. In this way, in our day, the mycotic has displaced the neurotic theory.

The contagious principle is not often disseminated without direct

exposure to the disease. Very slight isolation secures exemption from the attack. The bacillus has no great tenacity of life.

Whooping cough occurs with special frequency during convalescence from measles. The disease shows itself also in close relation to tuberculosis. It has long been noticed that tuberculosis often follows close upon the heels of whooping cough. It is impossible to say in a given case whether the whooping cough made the soil fertile or merely aroused the latent disease.

It is an error to consider whooping cough as a trivial malady. There occurred in England in one year, of 500,341 deaths, 10,318 deaths from whooping cough. In New York in one decade, wherein 4,062 deaths occurred from typhoid fever, there were 4,094 deaths from whooping cough. Hagenbach says that whooping cough had more victims in Basel in fifty years than any disease except typhoid fever and diphtheria. The general mortality is estimated at three to seven per cent. It has reached as high as forty-eight per cent in the second year of life.

Symptoms.—The disease begins with the signs of an ordinary catarrh of the exposed mucous membranes.

Whooping cough occurs, as stated, in paroxysms or explosions. It would appear as if the nerve centres suddenly discharged themselves of accumulated irritation, as in a case of epilepsy. Close observation of a case gives rise to the impression that the poison accumulates gradually up to a certain point, when it may be no longer stored and is discharged with the explosion that characterizes a paroxysm of the disease.

Whooping cough is usually divided into three stages : the stage of catarrh, of spasm, and of resolution. The first stage lasts about one week. Sometimes this catarrhal stage is very short, and the spasmodic element manifests itself at the end of the second or third day. Very soon the cough assumes the convulsive character, and sooner or later occurs the typical staccato cough, with the long-drawn, audible inspiration. The second stage has now set in. In these attacks the seizure is sudden. Sometimes, though not as a rule, there is a kind of *premonition or aura* which previous experience has taught the child to recognize. It is usually a *sense of impending distress* or danger, which leads it to leave its play and run to its parents, or grasp a chair for support. The aura may be in the form of a *dyspnœa*, a precordial distress, a nausea, sometimes an actual vomiting, whereupon ensues the *series of expiratory coughs* which distinguish the disease. The breath is lost. The face flushes or becomes livid. The eyes protrude. Saliva flows from the mouth. The look is wild, bewildered. There is for a few moments the appearance of imminent danger.

The *discharge* of the contents of the stomach and a mass of *glassy, glutinous mucus* from the throat closes the attack. But the scene may be repeated once or twice before the last spasm yields. Inspiration then becomes quieter, and the child, pale, covered with sweat, exhausted, sometimes almost in collapse, is released until the next attack. Meanwhile it recovers itself entirely, resumes its play, unmindful of the disease, until it is suddenly seized again.

Paroxysms occur in every grade of severity. They are sometimes so mild as to make the diagnosis difficult; in other cases so severe as to lead to rupture of vessels. Hæmorrhages may occur from the nose and mouth. Subconjunctival hæmorrhage is not uncommon. The membrana tympani ruptures at times, and free blood appears at the external meatus. Ectatic vessels burst in the skin in the face, in the cheeks, to show, visible at a distance, subcutaneous extravasated blood. Hæmorrhage from the stomach or intestine, or from the kidneys or bladder, is much more rare. Hæmorrhage in the brain, which sometimes occurs, is fortunately very much more rare. Hernia is not uncommon. Convulsions are possible. The duration of an attack is usually from a half to two minutes, though it seems to anxious, sympathetic relatives four or five times as long.

As the severity stands in quite close relation with the frequency of attacks, it is important that the number be counted, as by a stroke on a piece of paper or a slate, according to the suggestion of Trousseau. Diminution in the number of attacks is the first sign of approaching relief. Burman attributes the frequency of attack at night to the diminished vigilance of the respiratory centres, retarded and more superficial respiration, and greater accumulation of carbonic acid gas.

About the fourth decade of the present century attention began to be directed to the more or less constant appearance of an *ulcer on the frœnum linguæ*, due to friction of the protruded tongue against the inferior incisors. It is absent altogether where the attacks are very light, or where the frænum is short, or the tongue may not be protruded, or where the incisors are dull. It has been seen also independently of whooping cough, in cases of cough from ordinary catarrh, where the lower teeth have been unusually incisive.

The spasmodic stage lasts, as a rule, two to four weeks, when the interval between the paroxysms becomes gradually longer and the explosions themselves less severe.

Whooping cough is liable to many *complications*, especially on the part of the respiratory organs. Bronchitis belongs to the disease, and usually drowns all other sounds in the lungs with its râles. Any disease attended with bronchitis is liable also to broncho-pneumonia, and broncho-pneumonia is the most frequent of the serious

complications of whooping cough. The spasmodic closure of the glottis and the powerful efforts of the expiratory muscles sometimes develop œdema of the glottis, more frequently emphysema of the lungs. The wonder is that emphysema is not more universal. The occurrence of it is, in fact, an exception. It is usually slight, marginal or peripheral, and is marked by dilatation only of the air cells, whose walls are so resilient as to recover themselves entirely with the relief of the strain on cessation of the disease. Sometimes, however, especially in cases of failing nutrition, tuberculosis, syphilis, and rickets, the dividing walls are broken and air cells are ruptured. Still more rarely air may escape into the pleural sac to constitute a pneumothorax, or break the lung at its hilus, reach the mediastinum, or escape into the subcutaneous connective tissue and inflate, literally blow up, the upper half of the body. There is no better proof of the strength of the heart than the fact that it escapes damage under the spasm and stasis of whooping cough.

Complications on the part of the nervous system are very rare. At the height of the attack there is experienced extreme anxiety, a sense of suffocation, a vertiginous bewilderment, approaching loss of consciousness, which disappears entirely with the recovery of the breath. The momentary apnœa may be prolonged to the point of danger, and very young children may actually succumb to suffocation. Vomiting, which is usually hailed with pleasure as indicating the end of the attack, may be excessive. It may continue into the interval. It may even produce collapse, or in more protracted form lead to marasmus. More frequently a more or less decided convulsion ensues, and the case may be marked by a series of convulsions, any one of which may prove fatal. Sometimes cerebral symptoms continue during the interval, and the case may bear the aspect of a meningitis. Stupor, coma, and hemiplegia would indicate the occurrence of cerebral hæmorrhage.

Diagnosis.—The recognition of whooping cough in the convulsive stage is an easy matter. The series of rapid, sudden, explosive, breath-taking coughs, attended by the evidence of venous stasis, cyanosis (whence the old name blue cough), which ceases only when a quantity of mucus, under the combined efforts of cough, retching, and vomiting, is expelled ; the prolonged expiratory efforts, followed by a long-drawn, audible inspiration, which has been not inaptly likened to the bray of an ass; and the gradual cessation of the disease, sufficiently characterize it.

The *prognosis* is for the most part entirely favorable. Notwithstanding the threatened suffocation and tremendous strain upon the heart, recovery is the rule, and that without a trace of lesion. But complications and bad surroundings may intensely exaggerate the

natural benign prognosis. The prognosis is determined to considerable extent by the age and sex. The disease is, as stated, from some inexplicable cause, not only more frequent but more severe in the female sex. It becomes less and less grave with advancing life. Majer declares that ninety-seven per cent of all the fatal cases occur under the age of five; fifty-eight per cent in the first year. Biermer made a grand average of the established mortality rate, based upon the statistics of many authors, at 7.6 per cent, a figure that certainly entitles the disease to respect. The most frequent causes of death are: 1, suffocation from spasm of the glottis; 2, broncho-pneumonia; 3, hæmorrhage; 4, marasmus.

The prognosis is grave where the attacks reach fifty in the course of twenty-four hours; at sixty it assumes special gravity. Individual attacks may do damage also by their intensity; thus hæmorrhage may be copious from mucous surfaces. Blindness occurs occasionally, probably from œdema of the brain.

Prophylaxis.—As the disease has, at least at times, such gravity, prophylaxis assumes importance. The only prophylaxis worthy of the name is isolation. The patient must be separated, not only from children, but from adults who come in contact with unaffected members of the family. As this isolation, in a disease which is usually considered so mild, is practically impossible, attention should be directed rather to the protection of delicate members of the family; they should be isolated. It is advisable that tuberculous, rachitic, syphilitic, or otherwise diseased or debilitated children should be removed from the house as early as possible.

The most essential element in prophylaxis at all times is the destruction of the sputum. Though the individual is attacked with the suddenness of an explosion, mucus, at least in quantities, is not expelled until the attack has spent itself, so that there is, for the most part, time for the collection of sputum in water. As in tuberculosis, the handkerchief should never be used for the reception of sputum.

Treatment.—The older writers used the anodynes early. Opium, in some form or other, was the shield which was soon interposed. In more modern times the active principle of opium, morphia, was, and is still, extensively employed. With the morphia are often combined five- to ten-grain doses of the bromide of sodium or potassium, or there may be added the hydrochlorate of apomorphia. The remedies commonly employed in the treatment of bronchitis are also frequently resorted to. The syrup, simple or compound, of ipecac, one-half to one teaspoonful; the wine of ipecac in half these doses; minute doses of antimony, one-sixty-fourth to one-thirty-second of a grain; belladonna, one drop of the tincture for each year of life;

or atropine, one grain to one ounce of water, given in doses of from one to two drops two or three times a day. The iodide of potassium is a remedy of value. It may be given as follows:

℞ Potassii iodidi.....ʒ ss.
Aquæ menthæ piperitæ.....fl. ʒ ss.
M. Sig. Two to five drops in a dessertspoonful of milk three or four times a day.

Excessive vomiting may be relieved by chloral, gr. ii.–v. Mild cases are best let alone. Bad cases call for control by opium. Change of climate is the only remedy which does really sometimes "act like magic."

INFLUENZA.

Influenza; la grippe; the grip.—An acute infection caused by a specific bacillus and characterized by catarrhal, gastric, and nervous signs.

Influenza has the same origin as catarrh, rheumatism, etc.—diseases derived from the Greek word meaning a flow or flux—but differs from these diseases in the fact that its origin came not from within but from without. It was derived, in the most ancient times, from extraneous influence. It was the "influence" of the stars or of the weather, mysterious telluric influence, that constituted influenza—an Italian word.

Influenza takes the front rank among the acute infections on account of its extent. It surpasses all other diseases in its range, in that it often covers the entire globe. It is the type of the pandemic diseases. It never attacks solely individuals, but always communities, peoples, hemispheres.

History.—Accounts of it date from the earliest times, and when first seen its universal distribution was appreciated. It was certainly recognized as early as 1173 in Italy, Germany, and England. It prevailed as a true pandemic from 1510 on, at different periods, with intervals ranging from forty to one hundred years. It showed itself in our own country first in 1627 in Massachusetts and Connecticut, and extended to the West Indies and South America as far as Chili, and it reappeared again and again with us, at varying intervals of five to fifty years, without any distinct periodicity, up to the present time. It is established of influenza, in a general way, that it originates in the East and extends over the West. Thus the most recent epidemic that has visited our country was first recognized in Bokhara in May, 1890. It reached St. Petersburg in October, Berlin in November, London in December, and by the middle of December showed itself in individual cases in Philadelphia and New York, whence it gradually extended over the United States, to appear in Mexico in the following spring.

Etiology.—The first cases of influenza are usually unrecognized. The individuals affected are said to be attacked with a bad cold, or nervous phenomena are interpreted as signs of other diseases, typhoid fever, etc. It is only when individual cases multiply that the poison accumulates to sufficient extent to strike the masses, and this fact has led to the belief in the sudden appearance of epidemics. Influenza is spread by human intercourse. It follows the line of travel, and extends with the transportation of individuals by river and rail, with the velocity in our day that corresponds to the rapidity of modern transit. Having traversed a country and gone beyond it, it is liable to return and reappear, especially among individuals previously spared, and thus the disease hovers about a country for a period of months, sometimes years, before it entirely disappears.

The cause is in the air. Crews of ships have been seized in the open sea. The fleet under Admiral Kempenfeld had to put into harbor in the second week at sea, having had in the meantime no connection with the land; and this observation has been repeatedly made. Hermits are said to have been attacked in the woods, or in the caves of their isolated homes.

Influenza travels against the wind as well as with it, and is totally independent of climate, season, or soil. It is difficult to fix the place amongst the acute infections where influenza belongs. Whether it shall be considered a miasmatic or a contagious disease will depend altogether upon what is meant by these terms. Advocates of miasm contend that the disease originates *de novo*, or that it is carried by the wind, and meet the objection that it is often carried against the wind by the assumption that the wind at greater altitudes moves in a different direction. We are, however, little concerned with the direction of the upper strata of the air. The wind at high altitudes is more liable to blow down the castles we build in the air than to affect the habitations in which we live.

It is observed of influenza that it shows itself first along the lines of river and rail, and that it appears first in towns about railroad stations, later in places removed from the lines of travel. Pfeiffer (1892) discovered the micro-organisms of influenza as bacilli in the pus cells of tracheal mucus. They are minute structures, about the breadth and half the length of the bacilli of mouse septicæmia. They are best displayed with the dilute Ziehl or in the hot Löffler methylene solution. They are immobile in hanging drops. The bacilli of influenza form colonies on one and a half per cent sugar agar, visible only with a lens, in drops as clear as water. An absolutely distinctive feature, according to Kitasato, is the fact that these drops *always remain apart;* they never coalesce. The bacilli penetrate the peribronchial tissue to reach the surface of the pleura. Canon, in

the same year, demonstrated the bacillus in the blood itself. Toxines from these micro-organisms develop the complications and sequelæ—endocarditis, nephritis, etc.—of the disease.

No period of life is exempt, though infancy is comparatively rarely attacked. The greatest liability ranges from twenty to thirty. The period of danger is in advanced life. The incubation is short, two to three days. In most cases the onset is sudden.

Symptoms.—Prodromata, when they exist in the exceptional cases, consist of malaise, languor, headache, light catarrh. The disease *sets in*, as a rule, *suddenly*—a fact of value in a diagnostic way—and distinguishes itself in its course by three sets of symptoms, to wit, the *catarrhal*, *gastric*, and *nervous*. Epidemics vary greatly with reference to the intensity or predominance of individual symptoms. Individual cases vary in still greater degree. It is, however, the coincidence of symptoms on the part of these various organs which establishes the nature of influenza and distinguishes it from other catarrhal affections. The catarrhal symptoms may affect any part of the respiratory tract; *i.e.*, there may be *coryza, irritation, burning, dryness, or discharge from the nose, sneezing*, hyperæsthesia of the conjunctiva, *photophobia*, or catarrhal affection of the throat which may not be distinguished from a simple angina. There is much more commonly catarrh of the bronchial mucous membrane. The *bronchitis* of influenza distinguishes itself by its universality. It is a *bilateral affection*. It shows great disposition to extend to and involve the capillary bronchi, whence the liability to, and danger of, *catarrhal pneumonia*. There is corresponding oppression about the chest, difficulty of breathing, precordial anxiety.

The gastric symptoms are more marked in childhood. The disease is often announced in children by *vomiting*, and cases have been reported in which the severity of the vomiting has excited the suspicion of the development of scarlet fever, cerebro-spinal meningitis, or pneumonia. As a rule, however, gastric symptoms are marked rather by anorexia, sometimes *nausea*, *dyspepsia*, more especially *duodenal catarrh* with a *light icterus* manifest in the tint of the conjunctiva. Exceptional cases show diarrhœa, or even bloody discharges.

It is the third set of symptoms—the nervous symptoms—which more especially distinguish influenza from other catarrhal affections and give it its specific place as distinct from common catarrh. There is *headache*, some of which may be accounted for by catarrh in the frontal sinuses, most of which, however, is toxic. There is *supra-orbital neuralgia*. The headache is frontal, more rarely occipital. Neuralgic pains wander about the body. Patients complain especially, often bitterly, of *deep-seated muscle and bone*

pains. There is with these pains *great depression of spirits*, something more than the mere hebetude of the inception of typhoid fever. These *sinking sensations*, which take the interest out of and create a disgust for life, characterize well-marked cases of influenza. In exceptional cases nervous symptoms of graver character occur. The disease may be announced in a child in epileptiform convulsions. Various paralyses, chorea, tetanus, psychoses have been noticed in different cases. A patient may be affected with insomnia for a week. Roger reported the case of a lady who slept for over a week. Da Costa mentioned the case of a woman, of great delicacy and refinement, who greeted the appearance of the physician with blasphemy.

Influenza calls out latent diseases. This is especially true of *tuberculosis*. Many cases date the origin of their various diseases to an attack of grippe. "I was all right until I had the grippe," is a common observation; and while it is possible here to confound with influenza the symptoms of individual diseases, as of tuberculosis or pneumonia, it remains true that influenza is a common exciting cause of these affections.

Diagnosis.—The three sets of symptoms—catarrhal, gastric, nervous—distinguish the disease. Influenza is overlooked or misinterpreted only in the beginning of an epidemic when the cases are few. The predominance of nervous distress, more especially nervous depression and dejection, is a characteristic feature of the disease.

Prophylaxis.—According to observations Goldschmidt, of Madeira, made in the presence of both diseases as epidemics, revaccination with vaccine virus protects not only against variola, but also against influenza. This statement needs verification.

The *prognosis* of influenza itself is good; the mortality is almost *nil*, but the fraction of one per cent—Lynrote says 0.25. Lee reports 1,120,000 cases in Pennsylvania in the last epidemic, with 7,780 deaths, or 1 in 142 cases. Nevertheless, the occurrence of influenza is a serious thing. It calls out, as has been stated, latent diseases. It aggravates the progress of all diseases in course and terminates many fatally. The disease assumes special gravity in age. It is difficult for an aged person to escape an attack of influenza with good health. It is the indirect cause of death in many of these cases—indirect through catarrhal pneumonia or heart failure. So the death list is duplicated through the prevalence of pneumonia; and while it is true that the mortality list at the end of the year is not sensibly increased by the occurrence of an epidemic of influenza, it makes a great difference in a community whether these deaths be diluted through a period of months or years or be concentrated upon a few weeks.

The *treatment* is now nearly specific. To meet individual symptoms and sustain the patient for three to five days constitutes the rational therapy of influenza. A most essential factor is rest. All patients affected with influenza should observe quiet and repose of mind and body in a properly ventilated and warm room.

Fever seldom calls for treatment. The temperature rarely rises above 101° or 102°, and when excessive is best met by sponge baths.

The pain is best relieved by broken doses of Dover's powder, or, in the presence of much nausea, by phenacetin. Phenacetin may be given in a single dose of ten grains to an adult to secure a peaceful sleep. Caution must be entered against the abuse of any antipyretic. Where there is much debility from age or heart weakness, quinine may take its place. The salicylates have something of a specific influence in relief of the symptoms of influenza. Choice may be had as between salicin, salol, and salicylate of soda. All these agents, however, have a sensible though slight effect in depressing the circulation, and should be administered in conjunction with a stimulant, a glass of wine or a dessertspoonful or tablespoonful of whiskey. A good salicylate in the treatment of influenza is the salicylate of cinchonidia. Support of the Peruvian bark principle counteracts the depression of the salicylic acid. It is bitter and insoluble, and hence should be given in capsule or pill in dose of two to five grains every two to four hours. The best single remedy is salipyrin, which may be given in powder or wafer in the dose of grs. x.–xv. every two to four hours. Salipyrin is almost a specific in the treatment of influenza. During the attack all patients should remain at home at rest, and in convalescence should expose themselves with caution.

HAY FEVER.

Hay fever; hay asthma; *catarrhus æstivus*, summer catarrh; June cold.—Catarrh of the mucous membrane of the eyes and air passages, produced only in sensitive subjects, by pollen, hence periodic in recurrence and protracted in duration.

History.—The disease is modern not only in recognition, but actually in origin. It was first announced by Bostock (1819) as a "periodical affection of the eyes and chest," based on personal experience. Elliotson (1839) pointed to pollen as the probable cause of the disease. Helmholtz, also a sufferer, ascribed it to vibrios and lauded quinine by insufflation in its relief. Blackley (1873), another victim, proved pollen to be the true materies morbi. Beard (1876) laid stress upon the neurotic temperament which constitutes the susceptibility to the disease. The condition of the nasal passages themselves, as constituting susceptibility, is a contribution of the last decade.

Etiology.—Hay fever is a rare disease. It demands a peculiar susceptibility or idiosyncrasy, as, of the millions exposed, but very few are attacked. It is almost confined to the Anglo-Saxon race, and follows it in foreign lands, as in Asia and Africa, where the disease is unknown to the natives. It spares foreigners for the most part in England and America. It shows predilection for males in the ratio of 2 : 1, probably because of their greater out-door exposure. It shows preference also for the upper classes, especially for the clerical avocations. It attacks maturity up to forty, only very exceptionally youth or age. The liability is transmitted by heredity; and whether inherited or acquired, once developed the disease recurs with great regularity or periodicity about the same time every year. Certain cases have anatomical foundation in the condition of the nose, in occlusions, hypertrophies, polypi, sensitive areas, etc.

Pollen is the chief if not the only cause. Blackley proved by experimentation upon himself and others that the disease was caused by pollen, aggravated by greater exposure and limited by less, as by active movements out-doors or quiet within. The pollen of many plants will produce it. That of the graminaceæ causes ninety-five per cent of cases. Wyman ascribed most of the cases in America to the wormwood, which blooms in August and September. The pollen of plants in blossom often fills the air, is wafted at times to great distances, many miles, to be deposited, sometimes visibly, on roads and streets, where it may appear like sulphur.

Symptoms.—Hay fever begins, as a rule, suddenly, at or about the day it is due—wherein it may be helped by a lively imagination—as a coryza or an asthma. The disease shows itself in two forms, *catarrhal* and *asthmatic*. These forms may follow each other or coexist. In the catarrhal form there is *coryza*. The conjunctivæ are inflamed, *the eyes burn*, and hot tears run over upon the face. There is *photophobia* and *headache*. The *nose itches and burns*. There is *sneezing*, sometimes violent and persistent. The whole tract of the nose is blocked by œdematous swelling, often of rapid onset, of the entire mucosa. The *voice is nasal*. The inflammation extends to the *throat*, which is also *red and dry*, with sensations of *rawness* and actual *pain*.

In the asthmatic form there is sudden, *oppressive*, and persistent *dyspnœa*. *Wheezing sounds* pervade the entire chest. With this distress there is the *depression of spirits* and disinclination or actual incapacity for effort which belongs to true asthma.

The *diagnosis* depends upon the recurrence—periodic—in summer, and persistence throughout the exposure.

The *prognosis* is good, *quoad vitam*; bad, *quoad valetudinem*.

The disease subsides to leave no trace, but recurs every year and lasts for weeks or months.

The *treatment* is addressed to the temperament or tendency, with the administration of, especially, arsenic, which, in the form of the liquor potassæ arsenitis, is given in doses of gtt. ii.–v. ter in die to tolerance. The remedy should be begun before the attack. Quinine ranks next in dose of gr. v. twice a day, morning and evening. During the attack some relief may be obtained with solutions of cocaine, four to ten per cent, applied with a brush or by insufflation. Unfortunately such relief is too temporary to be of much value. The insufflation of an ointment of boric acid and vaseline, gr. xv. to ʒ ss., soothes the irritated nasal membrane. Intense conjunctivitis may be relieved by the instillation of a solution of cocaine, four per cent, or of morphia gr. iv. to aqua destillata ʒ ss. Gargles of potassii chloras, or internal exhibition of the solutio saturata, ʒ i. every two hours, help the throat. Chloral in small doses, gr. v., may relieve the asthma. It is common practice to administer the iodides in this as in other asthmas, being careful to avoid iodism. Belladonna generally does more harm than good. Morphine in small dose, gr $\frac{1}{2}$–$\frac{1}{8}$, is sometimes indispensable. Phenacetin or the salicylates relieve the headache and the fever. Patients should stay in-doors and keep quiet. The only radical relief is change of climate—*i.e.*, sojourn in some place distant from the cause, as at the White Mountains, Fire Island, etc. But individual cases yield to surgical treatment, the application of the galvano-cautery, chromic acid, trichloracetic acid, etc., after cocaine.

PNEUMONIA.

Pneumonia (*πνευμονία, πνεύμων*, the lungs); fibrinous, lobar, genuine pneumonia.—An ubiquitous, non-contagious, acute, general infection, with its main local expression in the lungs; caused by a diplococcus; characterized by high fever, pain in the side, cough with expectoration of a glutinous, rusty-colored sputum, consolidation of the lungs with coagulated blood, and resolution in five to nine days with *restitutio ad integrum.*

History.—Pneumonia was known as such and as peripneumonia by Hippocrates, though not separably, in antiquity, from pleurisy and other painful affections of the lungs. Even Sydenham (1670) failed to distinguish between pneumonia and pleurisy. The gross anatomy was first described by Morgagni (1761). Pneumonia was separated into the three well-known stages, congestion, hepatization, and suppuration or resolution, by Laennec (1819), by whom the disease was first recognized in life; the lesion (croupous exudation) was first

accurately described by Rokitansky (1841); the physical signs and diagnosis were definitely established by his contemporary and colleague, Skoda. Acute croupous or fibrinous is so-called from its exudation; lobar, from its extent; genuine, in distinction from catarrhal, hypostatic, metastatic, etc., forms of pneumonia.

Etiology.—Pneumonia, in all time limited as a local disease, "the type of the acute inflammations," was finally evolved as an acute, general infection, with main local expression in the lungs, by Jürgensen (1872); a pathogenic micro-organism discovered by Friedländer (1883), and more conclusively demonstrated by A. Fränkel (1886). The frequency of pneumonia is evidenced by the fact that it constitutes three per cent of all diseases and six per cent of all internal diseases; its gravity by the fact that it causes 6.6 per cent of the total mortality and 12.7 of the mortality of internal diseases, ranking thus in frequency and gravity next to tuberculosis. The disease occurs at all ages—three-fifths of the cases before the age of fifteen; and at all seasons—two-thirds of cases in spring and winter (minimum, September to November), with predilection for feeble constitutions and in-door life. Sinking subsoil water releases soil bacteria; rainfall by precipitation frees the air. The history of seven hundred and fifty cases examined by Dietl showed previous perfect health in but eighteen per cent. Contrary to common belief, pneumonia is not contracted by trauma or by taking cold. Trauma may produce an inflammation of the lungs, but not a croupous pneumonia. Under trauma are included inhalations of dust. Thus the percentage of cases among coal merchants not especially exposed to dust is 14.4; among coal miners, working in almost suffocating dust, but 4.7. Excessive use or straining of the lungs, as in playing wind instruments, crying vocations, etc., do not predispose to attack. Regarding "cold" it may be said that over eighty per cent of individuals attacked can recall no exposure in explanation of the origin of the disease. Soldiers are attacked in garrison life, seldom during field service; sailors ashore or when near the coast, seldom upon the open sea. Deaths from pneumonia among the nuns of Paris amounted to 7.02 per one thousand; among washerwomen, 3.05. Among six hundred and seventy laborers constantly exposed to cold and wet, engaged in loading vessels, Parent-du-Chatelet found but one case of "congestion of the lungs." Prisoners and factory girls furnish a large contingent of cases. The ratio of deaths among denizens of cities and the country is as 5 : 2. Cold and trauma may, however, act exceptionally as exciting or localizing causes in cases where the real cause pre-exists in the body, just as injuries to the skull and spine may localize abscess of the brain and caries of the spine, or measles excite tuberculosis.

It was the recognition of these facts, together with the observations that the disease (1) has different temporal and spatial relations from affections commonly ascribed to taking cold; (2) that other organs besides the lungs—notably the heart, brain, kidneys, and spleen—are often also involved; (3) that the general symptoms, fever, prostration, gastro-intestinal signs, etc., do not, by any means, of necessity correspond with the extent of invasion of the lungs, which should be the case in a local disease (*i.e.*, slight invasion often shows grave symptoms, and *vice versa*); finally, (4) that the disease runs a specific course, terminating at a definite period, after the manner of most of the acute infections—which led Jürgensen, a close, keen, and critical observer, to anticipate the disclosures by the bacteriologists of the real cause of the disease in certain definite micro-organisms.

FIG. 89.—Pneumococcus of Friedländer; oval cells with gelatinous envelope.

Bacteriology.—Of the various micro-organisms found in pneumonia, two have been finally eliminated as pathogenic — viz., the pneumococcus of Friedländer and the diplococcus of Fränkel. Friedländer and Frobenius described as "pneumococcus" certain micro-organisms discovered in sections of hepatized lung tissue, in the alveolar exudation, and later in the rusty sputum. These micro-organisms could be cultivated and inoculated to produce the disease.

Inspected in hanging drops they are seen to be thicker in one diameter, hence to constitute really very short bacilli. As found in the body they are enveloped in a distinct capsule which encloses, as a rule, but one, exceptionally two or more elements. They belong to the class of facultative anaërobes; thrive, hence, without oxygen. They are motionless. In staining, the capsule remains uncolored. They do not fluidify gelatin, and develop in the test tube in the form of a nail with a thick head. They thrive upon agar and luxuriate upon the potato. They are found in but 5.5 per cent of cases.

FIG. 90. — Pneumococcus of Friedländer; stick culture in gelatin, nail shape.

It is now established that the true pathogenic micro-organism of pneumonia, found almost universally in typical cases—ninety-two per cent of cases (Weichselbaum)—is the "diplococcus" of Fränkel (first seen and described by Sternberg), which is closely allied to the pneu-

mococcus of Friedländer. This coccus is also, strictly speaking, a bacillus, with one end pointed—"lancet-shaped" (see Frontispiece, Fig. 6). It is found in pairs, whence the name; sometimes in rows or beads of five or six or more elements; is also encapsulated in the body, but never out of it as in cultures. It differs from the pneumococcus in admitting of double coloration, and in not being decolorized by Gram's method. It grows with difficulty upon gelatin, thrives upon agar and in bouillon. Injected into the blood of rabbits and guinea-pigs, it produces septicæmia, which is fatal in twenty-four to forty-eight hours. Introduced directly into the lungs of rabbits, mice, guinea-pigs, and dogs, it produces intense inflammation of the pleura with condensation of the lung tissue, identical with the lobar pneumonia of man. A peculiarity of this micro-organism is the rapidity with which it loses its virulence in four to five days. Successive cultivations with every precaution show loss of infecting properties, which can be maintained only by return to the animal body every ten days. Heat attenuates and finally abstracts the infectious principle, and thus the diplococcus becomes attenuated in a few days at 41° C. and innocuous in twenty-four hours at 42° C. These diplococci have been found in the dust of the floors of houses, as also in the saliva of healthy individuals, as have, however, other pathogenic micro-organisms, Staphylococcus aureus, actinomyces, etc.

FIG. 91.—Diplococcus pneumoniæ (Fränkel-Weichselbaum): *a*, lancet shape; *b*, in gelatinous envelope; *c*, *d*, in rows and beads.

The avenue of entrance into the body is not definitely established. It has wide distribution in the body: throat, ear, meninges, joints, kidneys, pleura, peritoneum, etc. Inhalation experiments do not furnish uniform results. Entering the lungs, it excites in these organs specific inflammation, attended by hyperæmia and hepatization, to be followed by fatty and mucous degeneration and the stage of resolution. From the lungs or other portal it enters the blood, in which it has been occasionally detected, to lodge by preference, in individual cases, in the spleen, kidneys, endocardium, and membranes of the brain, etc. Whether the inflammation in these organs depends in all cases upon the diplococcus of pneumonia or upon other secondary invasions, as of streptococci, staphylococci, etc., remains as yet undetermined. The differentiation of the diplococcus from the pathogenic streptococcus is often very difficult.

The short duration of the disease corresponds with the short life or infectiousness of the diplococci. They evolve products, antitoxines, fatal to their growth. Phagocytic processes not yet demonstrated of these micro-organisms do not need to be invoked to

account for the duration or the recovery from the disease. Irregular, secondary, and complicated cases of pneumonia may be produced or explained by invasion of other bacteria, as by the streptococcus, staphylococcus, other diplococcus, typhoid bacillus, etc., all of which may undoubtedly produce inflammation of the lungs.

Symptoms.—Pneumonia begins, as a rule, suddenly, without premonition or prodromata, which may, however, occur in less than one-fourth of cases. Thus malaise, wandering pains, and disturbance of digestion may precede an attack of the disease one or two days. Pneumonia is generally announced by a violent *chill, often at night*, the severity of which is equalled only by a sharp attack of malaria or small-pox. The chill is especially pronounced in adolescence or adult life. In infants the onset is marked by coldness of

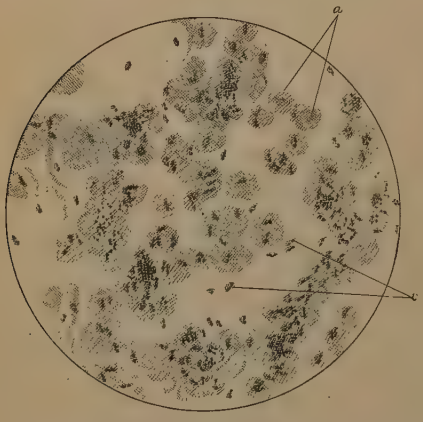


FIG. 92.

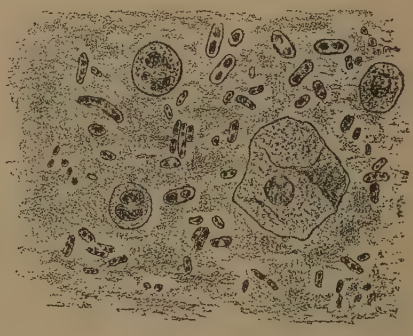


FIG. 93.

FIG. 92.—Diplococci from sputum, acute pneumonia, early stage: *a*, pus cells; *c*, diplococci with capsules (Woodhead and Hare).

FIG. 93.—Diplococcus of pneumonia in sputum, much more highly magnified.

the surface, vomiting, convulsions, or even coma; in the aged and cachectic the onset of the disease is much more insidious.

Fever rises rapidly, reaching its greatest elevation about the third day. The chill and fever are accompanied or quickly followed by sharp *pain in the side*, due to accompanying pleurisy, for lung tissue itself is not sensitive to pain. Pain is, as a rule, wanting in old people, in whom the disease usually begins more centrally, to extend outward much more gradually. By the second day the fever is high, especially in young patients. In children it not infrequently reaches 105°. In adults 104° represents an average case. The temperature is often out of all proportion to the amount of invasion of the lung. It may stand at 105° when the lesion of the lung may be difficult to fix, or may scarcely show itself until the half or whole of

the lung is blocked with blood. After the third day the fever begins to show daily remissions, and by the fifth to the seventh day it falls suddenly, especially in the young, reaching the normal degree within thirty-six hours—*i.e.*, by crisis. The "crises" (*κρίνω*, to decide) of the older writers were mostly based upon studies of fever in pneumonia. In the majority of cases, however, fever ends rather by a rapid lysis (*λύειν*, to dissolve). Fluctuations occur throughout the disease. Such uniform or sustained elevations as are characteristic of typhoid fever are unknown in pneumonia. Crisis is preceded or caused by leucocytosis, which liberates antitoxines. The ratio of white to red corpuscles may be at this time 1:60 or 1:40—a valuable prognostic point. The fall of temperature, with general

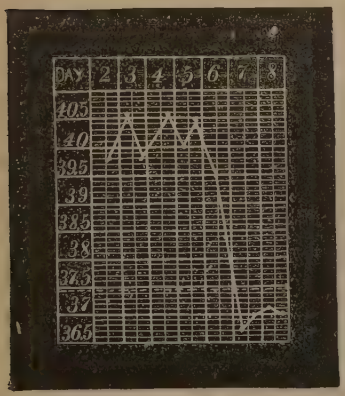


Fig. 94.

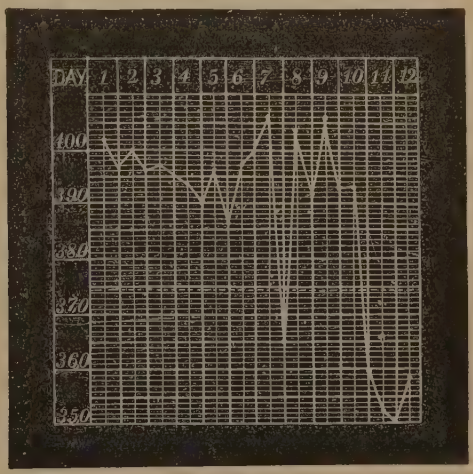


Fig. 95.

Fig. 94.—Temperature chart; fibrinous pneumonia; adult; crisis on sixth day.

Fig. 95.—Temperature chart; fibrinous pneumonia in child; pseudo-crisis on seventh, real crisis on tenth day (Eichhorst).

subsidence of symptoms and resolution of the disease, occurs in twenty-three per cent of cases before the seventh day, in seventy-six per cent before the ninth day. In advanced age, or cachexia at any age, the fever frequently runs quite a different course, the ascent and decline being much more gradual and the course more protracted. The typical curve is also altered by complications. This rapid rise of temperature at the start distinguishes a typical pneumonia from a typical typhoid fever.

Cough commences within the first two days, often with the pain. It is due either to associate bronchitis or pleuritis, usually to both. Since some degree of bronchitis is always present, *expectoration* consists at first of frothy mucus, to assume later a more significant

appearance. The sputum becomes *thick, viscid, tenacious,* adhering to the receptacle like glue, even when inverted. About the second or third day, in a large proportion of cases, it has imparted to it a peculiar rusty or *brick-dust color,* due to admixture of blood corpuscles. This color is not usually present in pneumonia in old age. Pure blood may show itself in streaks, or be itself the sole constituent of sputum. Liquid, black or dark "prune-juice sputum," often accompanied by fœtor due to mixed infection, is of grave import as indicating decomposition of the blood. Purulent sputum, which is more common, also proves mixed infection with pyogenic bacteria, but is not of necessity so grave.

Respiration is soon *increased* to 30 to 40 per minute. It is *hurried, shallow, superficial,* and *painful*—painful because of pleurisy. It is, as a rule, more rapid in children than in adults ; it may remain unaffected in age. The pulse, 100 to 120, full and bounding at first, becomes later soft and feeble. It is not increased in the same ratio with the respiration. Very early in the progress of the disease the *pulse-respiration ratio is disturbed,* respiration being hurried out of all proportion to the pulse. Thus the normal ratio, two to nine, or one to four and a half, may become two to four, two to three, or even one to one. The majority of cases show *temporary albuminuria,* due to retarded circulation during the height of the disease. *The chlorides diminish* and may be entirely absent from the urine, as is readily shown by the nitrate of silver test. They reappear about or at the time of crisis. This sign has lost much of its former diagnostic and prognostic value since the observation that the same change occurs in the urine in other fevers. The presence or absence of chlorides is largely a matter of refusal or lack of digestion of food.

Herpes occurs in about fifty per cent of cases. The vesicles appear *upon the face* or exceptionally over the body. Herpes is of prognostic as well as diagnostic significance. It does not show itself in typhoid fever. In a large majority of cases in which it occurs in pneumonia in well-developed form it foretells recovery. The appearance of herpes is more welcome because it shows itself early, usually about the third day of the disease. Unfortunately it does not occur so often in age.

Physical Signs.—Pneumonia picks by preference upon the right lung, the base rather than the apex. It is bilateral only in exceptional cases, and then more especially in drunkards. Pneumonia at the apex is often confounded with tuberculosis. Inspection shows *limited expansion.* The difference in the excursion of the two sides is best seen when viewed from behind. It is perhaps better appreciated by palpation than by inspection, the hands being placed flat

upon the postero-lateral parts of the chest. Percussion may disclose an alteration of the note, even early in the stage of hyperæmia. The sound may become tympanitic and thus deceptive. This sign is wont to recur after resolution, and may persist for several weeks. A little later, in a few hours to two or three days, *percussion* shows *dulness* over a sharply defined area. It may be observed only upon the posterior aspect of the chest. When doubt arises as to the char-

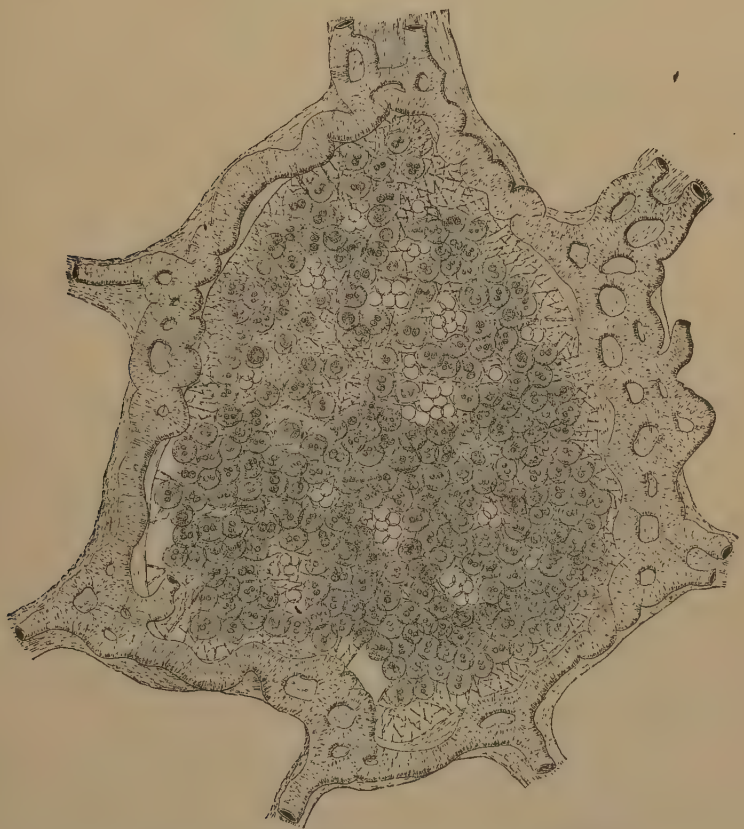


FIG. 93.—Section of alveolus of lung in croupous pneumonia, filled with exudate consisting of fibrin, with desquamated epithelium and red and white blood corpuscles.

acter of the pneumonia, whether croupous or catarrhal, unilateral dulness speaks for croupous, bilateral for catarrhal pneumonia. Vocal fremitus and resonance are both increased. Auscultation furnishes the most valuable evidence in pneumonia, as it reveals something characteristic in the first as well as in the second stage of the disease. During the stage of hyperæmia the bronchioles as well as the air cells become more moistened from exudation into their

interior, so that the act of inspiration separates them, and the penetration of air is attended with a *fine crackling sound,* the *crepitant râle.* This sound, which is often likened to that which is heard when salt is thrown on the fire, and is closely simulated by rubbing the hair between the fingers near the ears, is heard only at the end of full inspiration. Heard in this stage at this time, it is known as the crepitans indux. It is soon obliterated. The air cells and bronchioles are filled with blood, which coagulates to form a cast of their interior. The lung has become solidified. A piece of it exsected sinks in water. There is no longer question of the penetration of air beyond the larger bronchial tubes.

The second stage of the disease has now set in, and the natural vesicular râle, the crepitant râle, disappears entirely, to be substituted by bronchial respiration. Sometimes nothing is heard in the act of respiration. This silence is often more eloquent than sound, as indicating the effusion of fluid in the pleural sac. The crepitant râle is of value in establishing the nature of the disease, because it is heard *at the base of the lungs,* where other diseases which might produce it do not naturally exist. A crepitant râle may be heard also in tuberculosis, bronchitis, and is often closely simulated by the friction sound of pleurisy. The location of the sound under the clavicles in tuberculosis, everywhere over the chest in bronchitis, and in both cases with other associate sounds; the location of the sound in the region of the nipple in pleurisy, helps to distinguish these affections. With the bronchial respiration there is often *bronchophony,* heard, as a rule, most distinctly about the angle of the scapula, or, in apex pneumonia, under the clavicle. After the absorption of blood in the process of resolution the crepitant sound returns. It is then heard in connection with both inspiration and expiration, and is known as the crepitans redux. It is now, as a rule, accompanied by coarse and fine mucous and submucous râles.

Pneumonia resolves itself, as stated, in seventy-five per cent of cases, in from five to nine days. Most of the blood is absorbed, some of it is converted into mucus and expectorated. In certain cases the process of resolution does not occur. Suppuration takes place. The air cells and bronchial tubes are filled up with pus. The disease is said to have passed into the stage of suppuration. This process of suppuration does not belong to pure pneumonia. It follows mixed or subsequent infection with the micro-organisms of pus. It occurs in connection with the pneumonias produced by these micro-organisms, by that of the typhoid bacillus, etc. This event may not be known by any special change in the signs elicited by percussion and auscultation. It is recognized rather by general symptoms, by the prostration, weakening of the pulse, chilly sensations, rise and fall of tem-

perature, resulting from pyæmia ; sometimes by sweats, by the appearance of pure pus in the sputum ; sometimes by the appearance of disorganized blood to constitute the "prune-juice" sputum.

The pleura is almost always involved. The disease is essentially a pleuro-pneumonia. Sometimes pleurisy predominates throughout the history of the disease. Not infrequently it overshadows the pneumonia during the first few days. Ordinarily it subsides, so that pleurisy with perceptible effusion is present in but five per cent of cases.

As already stated, pneumonia is a general infection. Its chief local manifestation is in the lungs. It involves, however, other organs, in which it sometimes shows its main symptoms. In two hundred and thirty cases of pneumonia treated by Liebermeister in the hospital at Basel, occurred as complications : pleuritis with abundant exudation, forty-one times ; well-marked acute nephritis, but once ; diarrhœa, twenty-five times ; meningitis, probably on account of the prevailing epidemic of cerebro-spinal meningitis, twice ; pericarditis, nine times ; endocarditis, twice ; icterus, sixty-five times ; decubitus, five times.

The frequency with which the brain is affected is indicated in the old names, cerebral or meningeal pneumonia. Many cases are marked by nervous symptoms, especially in childhood and age. A temperature of 103° in childhood or 102° in old age is not uncommonly attended with delirium. The micro-organisms of pneumonia show a predilection for the meninges of the brain. Victims of alcoholism attacked with pneumonia show brain symptoms, as a rule. Slight albuminuria is often found in pneumonia, as in any febrile disease, due to high temperature and blood stasis. In a certain proportion of cases true Bright's disease ensues. The spleen is enlarged in about one-half the cases. Sometimes the disease seems to spend its force upon the digestive system with all the signs of gastro-intestinal catarrh. Icterus is a very frequent sign.

Though pneumonia is of short duration, it is frequently attended with serious parenchymatous change. In all cases the chief danger is on the part of the heart. The interference with the circulation throws *extra work upon the heart,* since it must force the same amount of blood through a smaller amount of lung tissue. The heart is also directly damaged by the toxic products of the disease. It becomes thus incompetent to do the extra work thrown upon it. Heart failure results. The majority of deaths in pneumonia is due, not to high fever, nor to sepsis in its ordinary sense, nor to any of the previously mentioned complications, but to *paralysis of the heart.* The condition of the heart is, therefore, the index to the situation. Heart failure may be indicated by general prostration, increase in

the dyspnœa, cyanosis. Above all other signs, the pulse in pneumonia is to be closely and continuously watched throughout the course of the disease. An irregular, compressible, fluttering pulse, fading when the arm is elevated, is a sign of a flagging heart. Nine-tenths of the deaths from pneumonia are due to heart failure, which shows itself, in the majority of cases, by the fifth or sixth day of the disease. Every effort is, therefore, made to conserve the strength of the heart, and under no circumstances is a patient allowed to rise in or from the bed. The mere elevation of the body for the purpose of examination has proven fatal. Bad cases should be simply turned over in bed.

Many forms of pneumonia were formerly described, based chiefly upon symptoms, not upon causes or lesions. True pneumonia runs a course so typical as to be explicable only by a uniform typical cause. But abortive, protracted, and irregular forms do undoubtedly occur, as do also rapid, migrating, asthenic, etc., forms. The pneumonia potatorum is a dangerous form. "Congestion of the lungs" is a common term for a pneumonia aborted in one or two days. After exudation there can be no abortion. Resolution, once begun, usually proceeds rapidly to completion, with *restitutio ad integrum* in the great majority of cases. Cachectic cases may be protracted even in the absence of complication. Cirrhosis, abscess, and gangrene of the lungs as sequelæ imply mixed infection. The same may be said of tuberculosis as a sequel. The diseases sometimes coexist, and certain cases of apparent pneumonia pass gradually into tuberculosis; especially is this the tendency when the pneumonia is apicial. This sequence is of course not a transformation, but is, in the majority of cases, an awakening of a hitherto latent tuberculosis. It must be understood, however, that a pneumonia, *pur et simple*, may run a typical course at the apex of the lungs. Catarrhal pneumonia may also coincide or supervene.

The differential *diagnosis* practically concerns, 1, *Typhoid fever*. Sometimes such a minor event as an epistaxis, which does not occur in pneumonia, or the appearance of herpes, which does not occur in typhoid fever, may turn the diagnosis in the early stage. Most cases of typhoid show diarrhœa early, whereas constipation is the rule in pneumonia. The temperature of pneumonia runs up rapidly, to reach its greatest elevation, as a rule, by the second or third day, while that of typhoid ascends gradually during a period of one or two weeks. The cloud about the brain, which so soon establishes the nature of typhoid fever, is absent in pneumonia, or present in only the last stages of the disease. In the course of a few days the physical signs in the chest in the one case, in the abdomen in the other, will usually clear up any doubt. A little later the roseola of

typhoid fever is distinctive. It must be appreciated that pneumonia and typhoid fever may coexist, and that the typhoid bacillus may produce pneumonia.

2. *Meningitis* is sometimes confounded with pneumonia. Cerebro-spinal meningitis is often announced in the same way, suddenly, with a violent chill, and both diseases may show herpes and constipation. In meningitis, however, early vomiting, opisthotonos, and hyperæsthesia develop rapidly, while physical signs on the part of the lungs are wanting. In doubtful cases the diagnosis may be established by the discovery of the diplococcus in the sputum. The preparation, colored with fuchsin, decolorized with dilute alcohol, recolored with methylene blue, shows the diplococcus blue in a red capsule. In seventy successive cases thus examined by Wolff the diplococcus was discovered sixty-six times, the pneumococcus three times, the result being negative in but one case. Inoculation experiments succeeded in twenty-two of twenty-four cases. It must not be forgotten that these micro-organisms have been found in the nasal mucus and saliva in health.

Fig. 97.—Diplococcus of pneumonia in sputum.

Thus also is the disease differentiated from, 3, *Tuberculosis*. The failure to make a correct diagnosis is due, in the majority of instances, here as elsewhere, to neglect of the proper examination of the lungs. This is especially true regarding the debilitated and aged, and the remark is worthy of repetition that pneumonia is a disease of age. The greatest number of old people succumb to this disease.

The *prognosis* of pneumonia depends upon three factors—the age, habits, and condition of the heart. In children the prognosis is good, the disease having almost no mortality at this period of life. In advanced age the mortality is estimated as high as sixty per cent. The disease is most fatal of all in drunkards. The existence of a chronic valvular disease of the heart intensely aggravates the prognosis. A pulse over 120 is grave. High fever is an index of gravity. Fenwick (London Hospital, one thousand cases from 1880 to 1890) found the mortality in direct ratio to the fever. Albuminuria is grave in proportion to its amount. Taking cases as they come, the mortality averages about ten per cent. The disease is, therefore, fully as fatal as typhoid fever with all its complications.

It is impossible to speak intelligently of *prophylaxis* without more definite knowledge of the mode of ingress and action of the cause of the disease. To inure the body by exposure to fresh air and by cold baths, with well-ventilated sleeping apartments, the avoidance of defective hygiene in every way that concerns the habi-

tation and the ventilation of the lungs, to protect the heart by avoidance of stimulants or mental anxieties, nearly covers the ground.

In *treatment* a case of pneumonia calls for a large, well-ventilated room. The temperature of the room should not be allowed to rise above 68°, as recorded by a thermometer at the head of the bed. Here it is important to remember and repeat the fact that the disease is not due to taking cold, and that there need be no fear in securing free ventilation. An abundance of pure air is of supreme importance in the treatment of this disease of the lungs. The respiratory centres are best stimulated, in the presence of high fever, with cold baths, or with baths which may begin at moderate temperatures and be gradually reduced. Where for any reason baths are impracticable, they may be substituted with an occasional dose of quinine or phenacetin. There is seldom call for the treatment of fever in pneumonia. Cough does not often demand special treatment. Any excess of cough may be best relieved by Dover's powder gr. ij. or iij., or apomorphia gr. $\frac{1}{16}-\frac{1}{12}$, or the syrup of senega 1 drachm every two to four or six hours. Small doses of morphia, gr. $\frac{1}{12}$ in cherry-laurel water or peppermint water, are most efficacious. Morphia also best relieves pain, and, by permitting deeper respiration, best prevents œdema of the lungs and protects the brain. Poultices or other external applications to the chest are of no value except in relief of pleuritic pain. Dry cups will drain an inflamed pleura, an ice bag sometimes gives intense relief, but morphia subcutaneously is the sovereign anodyne. Sleeplessness may be met by sulphonal or trional, gr. xv. in hot milk or tea, or by small doses of chloral, the latter always to be preceded by the administration of gtt. x.–xx. of dilute hydrochloric acid, or to be taken in connection with a wineglassful of sherry wine or a dessert- or tablespoonful of whiskey. Where the heart is feeble, as in the aged or drunkards, chloral must be administered with caution and in minimum dose, gr. ij. or iij. In these cases it is often better substituted by morphine, gr. $\frac{1}{12}-\frac{1}{6}$. Any undue intolerance of the stomach may be brought into subjection by small doses of chloral in peppermint water, or a drop or two of creosote, with the tincture of nux vomica; or, after failure of these remedies, by rectal injection of the bromide of sodium gr. xxx. or xl., chloral gr. v.–xv., or morphia subcutaneously gr. $\frac{1}{8}-\frac{1}{6}$.

The real danger, as stated, lies with the heart. The best support in ordinary cases is alcohol in the form of whiskey, which may be given to an adult in dessert- to tablespoonful doses every two to four hours. A call for a stronger stimulant may be met with brandy, with coffee, or both. Cold sponge baths always fortify the heart.

Among the drugs the most valuable are caffeine, the soda benzoate, two or three grains every two or three hours; strophanthin,

sparteine, and digitalis. Sparteine and strophanthin may substitute digitalis for a short time in case of great irritability of the stomach. Digitalis is always best when it may be borne. The infusion, fresh, made from the leaves, may be given in the dose of ʒ i. to ℥ i. every two to four hours, or the tincture, five to ten drops at the same interval. The danger of the drug is in tetanizing the heart, which may be avoided by withdrawing the remedy so soon as the hard, wiry, digitalis pulse begins to be felt. It is wise in all cases to administer some form of alcohol as the patient approaches the crisis, and it is not unwise to stimulate moderately from the start.

Behring, Kitasato, and the Klemperers utilized the antitoxine derived from the blood of immunized animals in prophylaxis and cure of the disease. The antitoxines in the blood serum of man rendered "immune by crisis"—*i.e.*, withdrawn just after the crisis—proved equally effective in the experiments of Neisser in aborting the disease. Such serum, withdrawn two or three days after the crisis, and injected, one hundred and thirty, seventy, and fifty cubic centimetres respectively, into the arms of patients in the height of the disease, cut it short within twenty-four hours.

TUBERCULOSIS.

Tuberculosis is the specific infection produced by tubercles, which are in turn special products of a distinct micro-organism known as the Bacillus tuberculosis, or, from its discoverer, Bacillus Kochii.

Tubercle is the diminutive of *tuber*, a nodule, induration, projection mass. Though the word tubercle is as old as anatomy, the term tuberculosis, in designation of a definite disease, is modern. Virchow has shown conclusively that tubercle, in its modern specific sense, cannot be found in the works of ancient writers, who used it only to express a morphological meaning. It is difficult to fix the time when the term began, by common consent, to be limited and confined to the special disease, for the reason that the distinct isolation of the affection is an acquisition of such recent date. But it is safe to say that the day begins with Bayle and Laennec (1810 to 1819) when they declared, with proof, that "tubercle is the cause and constitutes the proper anatomical character of pulmonary phthisis." As both Bayle and Laennec literally consecrated their lives to the study of this disease, they may be said to have earned the right to make, or rather to fix, its name. The word "tuberculosis" itself was first employed by Schönlein (1839), a disbeliever in the specific character of the disease.

Phthisis—literally *wasting, consumption*—was the Greek name, as an expression of the most prominent symptom of the disease. Phthisis was the term for the wasting disease attended or caused by

suppurations of the lungs; it included abscess, gangrene, suppurative pneumonias, empyemas, etc.—in short, all varieties of suppurative processes. As each of these affections was gradually eliminated and set upon an independent footing, phthisis came to be limited to the condition which, since the days of Laennec, is more properly known as pulmonary tuberculosis.

The existence of tubercles in the beginning or course of the disease, at some period or place in the body, justifies the adoption of the general name tuberculosis, while the localizations in the lungs, intestine, testis, etc., are sufficiently defined as tuberculosis pulmonalis, intestinalis, testis, etc.

The *history* of tuberculosis falls naturally into five periods, three

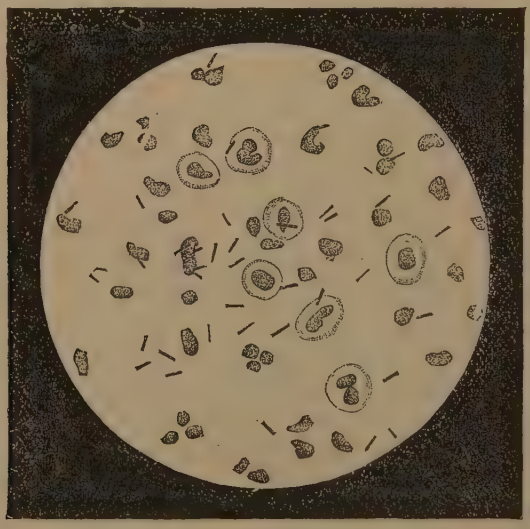


Fig. 98.—Tubercle bacilli—sputum.

of which, at least, are quite distinct, in that they date from the discoveries of distinct individuals—Bayle and Laennec, Villemin, and Koch.

The first is the period of ancient history. During all this period the disease was observed only from a clinical standpoint. The second period, beginning with the birth of anatomy in the sixteenth century, furnishes the first definite knowledge regarding changes or lesions of structure. The third period followed the publication of the discoveries of Bayle and Laennec in the first quarter of the nineteenth century, declaring tuberculosis a separate affection, due to the deposit of tubercle, a specific product independent of ordinary inflammation. This period is made more distinctly memorable by the

discovery of auscultation as a means of diagnosis. It was the genius of Laennec in the discovery of auscultation which first rendered possible a diagnosis of the disease in life. The fourth period was introduced late in the last half of the nineteenth century with the inoculation experiments of Villemin (1865) ; and the fifth was announced with the discovery by Koch (1882) of the tubercle bacillus as the definite cause of the disease.

The discovery of the tubercle bacillus gave the final death-blow to the doctrine that tuberculosis was ever in any sense secondary. The spectre of inflammation, which perpetually stalked to the front to obscure the true nature of the disease, was quieted forever.

Fig. 99.—Tubercle bacilli with spores, in sputum.

Instead of producing the disease, inflammation is itself relegated to a secondary place in pathology as a mere result of infection.

We may epitomize the history of tuberculosis with the statement that it was regarded first as a process of suppuration (pus) ; then as consisting of nodules, which in the third period are seen to be distinct tubercles ; fourthly, these tubercles contain a virus ; and in the final period the virus takes shape in the tubercle bacillus.

The tubercle bacillus invades the body through the lungs, in which it produces the disease commonly called consumption ; or, reaching the bronchial glands, is thence disseminated at some future time to the brain (meninges), bones (vertebræ, hip joint, etc.), and other organs and tissues (larynx, testis, serosæ, etc.), to lead to sepsis and slow marasmus. Introduced into the intestinal canal with

food (milk), it ulcerates the mucous membrane, to produce diarrhœa, marasmus, or fatal peritonitis.

Tuberculosis in its various forms destroys two-sevenths of mankind. Tuberculosis of the lungs alone carries off one-sixth of mankind and nearly one-third of the working class.

Etiology.—The tubercle bacillus is a slender rod whose length is about one-third of the diameter of a red blood corpuscle. It is about five times as long as broad. It varies somewhat in size, but presents such nearly uniform appearance as to be used as a standard of comparison for other bacilli. It lies usually slightly curved, but is often perfectly straight and uniform throughout its length, except where it is apparently broken by intervening highly refracting spherical spaces, four to eight in number, which are regarded as spores. Bacilli of rapidly developing disease show these spores in greater number.

FIG. 100.—Tubercle bacilli in sputum.

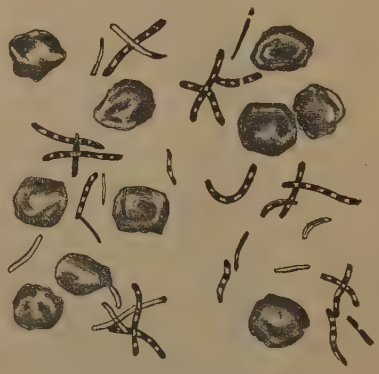


FIG. 101.—Tubercle bacilli in sputum.

In retrograde or quiescent processes they are usually entirely absent. The figures show various common pictures of the bacillus, with and without spores, in the sputum; also frontispiece, Figs. 10 and 16. A point of singular interest is the fact that the bacillus is quite as resistant to heat and destructive agents as the spores themselves. The Bacillus tuberculosis is distinguished by its extreme tenacity of life. It is invested by a membrane so dense as to be almost impenetrable by dyes in long saturation, or by the aid of heat. This very fact, however, which made the bacillus so difficult of detection, led later to its easier recognition; for the membrane, having once become permeated, retains the color in subsequent attempts at displacement, so that while an original color may be displaced in surrounding objects by a new dye, the bacillus retains its own color, whereby its presence may be recognized by difference or contrast of color; color

being more obtrusive than shape. Colonies cultivated with difficulty appear as scales upon the surface of the soil selected, usually gelatinized blood, and do not invade the substance of the soil.

What is the original source of the Bacillus tuberculosis? All that is known is that it has come down to us from the older civilizations. The Indians of our own country, the negroes of Central Africa, the inhabitants of islands of Australasia, never knew tuberculosis until it was brought to them by Europeans. So, too, tuberculosis was unknown in the North, among the Esquimaux, Laplanders, etc., until they received it by importation. Once received it is propagated by direct descent. Resistant as is the bacillus, so tenacious of life as to be able to live for months outside of the body, it is nevertheless a strict parasite. It may live, but not grow and multiply, outside of the body. Man, with many other mammals, especially the cow, offers the best soil for the growth and maintenance of the tubercle bacillus, and the disease is spread chiefly by the desiccation and dissemination of sputum. The sputum is nearly a pure culture of the Bacillus tuberculosis. Diluted 1 : 400,000 times, it will still propagate the disease in the bodies of rabbits and guinea-pigs, animals most of all susceptible to the disease. Inoculation is the final test in a doubtful case.

Fig. 102.—Tubercle bacilli in sputum.

Fig. 103.—Colonies of tubercle bacillus in scales on surface of blood serum, six weeks old.

The discovery of the fact, made by Koch, that the disease is chiefly conveyed by the dried and disseminated sputum, met with remarkable confirmation in the investigations of Cornet. Inasmuch as it had been impossible to discover the tubercle bacillus in the dust-laden atmosphere, or in the dust deposits upon walls, ceilings, furniture, etc., of rooms inhabited by tuberculous patients, Cornet undertook to collect it under every precaution, and to establish its infectiveness by inoculation of guinea-pigs, rabbits, and other sensitive animals. This experiment succeeded in two-thirds of the cases.

It had long been noticed that relatives in close association contracted the disease from each other—husbands from wives, wives more especially from husbands because of the closer contact and confine-

ment in the house. So the disease had been observed to extend through factories and prisons, showing a mortality equal to fifty per cent after a long confinement. It had been remarked, indeed, that confinement to prison for life is condemnation to death by tuberculosis. Flick called attention to the fact that so many cases occur in individual houses that a house remains a centre of infection for an indefinite time. Seventeen of twenty-two deaths from marasmus and meningitis in children occurred in houses which had been infected by tuberculosis of the lungs and bowels in adults. Niven observed that twenty-six of forty-five cases were contracted in a house where death occurred; sixteen in houses previously occupied by tuberculous patients. McMullen called attention to the danger of sea voyages with consumptive companions in confined cabins, and the same danger has been remarked, though in less degree, with the discovery of tubercle bacilli in sleeping cars. Individuals who make the beds, dust and sweep rooms of patients are the most exposed. Seventy-three per cent of nurses up to the age of fifty die of tuberculosis.

The tenacity of life of the bacillus was demonstrated in one remarkable experiment, where a feather bed upon which a consumptive lay was sent to five different cleaners in Berlin, and an infusion made of the feathers after its return the last time proved infective to guinea-pigs. The disease, therefore, is chiefly conveyed through the avenue of the lungs. Tuberculosis pulmonum is the common expression. The bacilli, inhaled and inspired everywhere in the bronchial tubes, come to lodge more especially at the apices of the lungs. Received anywhere in the bronchial tubes, they are more readily expelled from the middle and lower regions of the lungs, or are coughed up into the apices—parts furthest removed from the blood supply, regions also more quiet for growth and multiplication. There is no proof that the disease is ever inherited in man, though *inheritance* is assumed as a potent factor in the transmission of the disease. Thus it is said that of one hundred patients affected with phthisis, twenty-five will have had tuberculous parents; but if we recall the fact that these one hundred patients had two hundred parents, it will be seen that twenty-five represents heredity in but one-eighth of the cases, whereas we know already that tuberculosis is fatal, in the lungs alone, to one-sixth of all mankind. If the disease were produced by heredity it should appear first in the internal organs—the liver, spleen, the kidneys, etc. It should be discoverable also in the fœtus. It is known, however, that tuberculosis appears first in the lungs, and in children only at the end of one or two years of life. Advocates of heredity maintain, to account for the absence of the disease in the new-born child, that the micro-organism is transmitted in the form of spores. The burden of proof rests with

them. In the meantime it is observed that the disease appears nearly always in the lungs, whence it is evident that the cause of it is inhaled from the outside air. But when, in the more exceptional case, tuberculosis affects other, even distant organs, an autopsy reveals the existence, or the evidence of pre-existence, of caseous bronchial or mesenteric glands as depots or centres of infection. The theory of heredity is dangerous, in that it removes attention from the avoidable sources of the disease. It is unsatisfactory, in that it does not prove enough. It is also undemonstrable : experiments made to prove it are all open to objection. Finally, it is superfluous.

Certain individuals are said to be predisposed to tuberculosis. This *predisposition* is stated to be announced by an elongated, flattened thorax, a long, narrow neck, a thin skin with apparent blue veins, an enfeebled musculature, etc. This condition is declared to constitute the phthisical *habitus*. The truth is, these individuals are already the hosts of the tubercle bacillus and the victims of the disease. Deutsch has shown that there is no predisposition in the configuration of the thorax, and that broad-chested men contract the disease as readily as those with narrow chests. It is claimed that certain catarrhal conditions of the mucous membrane predispose to the disease. This may be, but the fact has not been demonstrated. Predisposition is probably largely a matter of quantity or number of bacilli inhaled. Conditions which markedly interfere with the nutrition of the lungs may be admitted to favor the retention and growth of micro-organisms. Thus it has been noticed that individuals in whom the pulmonary artery is small easily become victims to this disease. Congenital stenosis of the pulmonary artery is nearly always attended with or followed by tuberculosis.

On the other hand, certain anatomical conditions render an individual less liable to be attacked. Such conditions as favor venous stasis or hyperæmia offer obstacle to the development of tuberculosis. Thus tuberculosis does not occur, as a rule, in cases of valvular disease of the heart, asthma, or emphysema. Exceptional cases sometimes admit of explanation. Thus clinicians differ as to the effect of aneurism of the aorta. Aneurism of the aorta, so long as it causes a venous stasis, interferes with the development of tuberculosis. When it, however, attains such size or disposition as to encroach upon the pulmonary artery, it will favor tuberculosis. There is probably no such thing as an individual predisposition to tuberculosis. A man may have weak lungs, as he may have a weak stomach, weak eyes, or a weak brain. This weakness may be said to constitute a predisposition to disease of any kind, and in this way only may be admitted a predisposition to tuberculosis. Degraded surroundings constitute the chief predisposition to the disease.

Trudeau showed that infected rabbits confined in dark, damp holes speedily succumb, but allowed to run about in the open air recover from the disease.

The chief source of infection—by the alimentary canal—occurs through the milk of tuberculous cows. Bollinger showed that milk may be infectious even though the udder show no signs of disease. Ernst and Hirschberger confirmed this fact. Dilution of the milk, which diminishes the relative proportion of bacilli, renders it much less infectious, so that it may be said, as a rule, that milk from a large dairy is not so dangerous as milk from a single tuberculous cow.

Cases of infection through mucous membranes or the broken skin are much more rare.

Symptoms.—Tuberculosis of the lungs begins, as a rule, insidiously, and usually in one of three ways: first, as a *bronchial catarrh;* second, with general *failure of health;* third, as a *dyspepsia.* Other individual cases begin with disturbances of menstruation, with metrorrhagia, more especially with chlorosis or *amenorrhœa.* Other cases follow in the wake of a tuberculosis localized elsewhere, as in the bones of the spinal column or the hip. Not infrequently the disease of the lungs lies latent for a time until brought into prominence by some intercurrent affection. Measles and pertussis very frequently awaken tuberculosis. In a more exceptional case the disease appears suddenly as an acute pneumonia, acute pleurisy, a sharp hæmorrhage, etc.

The majority of cases begin with a bronchial catarrh. These individuals are said to have taken "cold." They are subject to taking cold. On every slight exposure they take cold, and the cold distinguishes itself by its persistence. They take cold with every change of weather, with every change of clothing, often without any kind of exposure. The cold becomes more suspicious when the cough which marks it occurs with greater frequency just after retiring, or just after arising in the morning. The change in the blood current is invoked to account for this occurrence.

A gradual deterioration of strength, vigor, color, appearance is noticed by relatives and friends. The individual is said to be "falling into a decline." The general degradation of strength and health very often overshadows the cold.

Certain poisons are evolved from the soil in which the tubercle bacillus grows to affect the nutrition, to produce dyspepsia. The menses are withheld, delayed, more especially in young girls about the time of puberty. In all these cases the physician entertains first the suspicion of tuberculosis. Pneumonias which are situated at the apex should more especially excite the suspicion of a tuberculous basis or origin. The pleurisies which are insidious in their develop-

ment, which are not attended with much pain, but are marked by more profuse effusions, belong to tuberculosis.

Bronchial catarrh becomes more significant when associated with *physical signs.* It must be remembered, however, that there is a pre-physical stage of tuberculosis, often of months' duration. Sooner or later characteristic signs develop in the chest. These changes can be recognized first by auscultation. The hyperæmia of the bronchial walls under the first irritations of tuberculosis roughens the inspiratory sound. The *inspiration* is said to be *rude,* like that of a child, *puerile.* Soon the elasticity of the lung tissue is impaired. It takes the lung a longer time to contract. Hence *expiration is prolonged.* This rudeness of inspiration and prolongation of expiration is observed in its finer shades only by comparison with the sound side. *Moist râles* develop later, and these moist râles of bronchial catarrh have peculiar significance in their localization. All these signs point to tuberculosis when they are fixed about the *region of the clavicles.*

As the disease advances these symptoms show themselves in greater intensity. The *cough* becomes more continuous, it prevents sleep at night, and so harasses the patient during the day as to lead in its violent efforts to vomiting and the loss of food. The cough shows itself in all grades of intensity in different cases, and in the same case at different times. It must be remembered that cough which is attended with expectoration is really salutary. Cough literally expectorates the disease, and it is only when it becomes so severe as to lead to the ejection of food, or so harassing as to prevent sleep, that it calls for alleviation.

The *expectoration* becomes now more characteristic. There is ejected along with the frothy mucus more or less solid matter, particles or pellets which are often *pure cultures* of the tubercle bacillus. The whole mass of the sputum becomes more solid. Expectorated in water, it assumes a more or less globular or coin shape and sinks to the bottom of the vessel. This is the *sputum rotundum fundum petendum* of the old writers. The quantity of the sputum varies in every degree in different cases, and in the same case at different times. At times violent efforts secure nothing. Again the sputum is so profuse as to constitute a bronchorrhœa. Many individuals empty cavities in the lungs in the morning upon rising, and then cough no more for hours or even during the day. This is the history of certain cases for months or for years. For the most part the cough varies. In states of fever, along with general dryness of the mucosæ, there is little or no expectoration. In apyretic states it is apt to be more profuse. With the extrusion of sputum the true character of the disease is disclosed. Whatever doubt existed be-

fore is cleared up with the *discovery of the tubercle bacillus or of elastic tissue.*

Certain cases, as stated, begin with *hæmorrhage* Many cases show no hæmorrhage from beginning to end. Hæmorrhage occurs in about half the cases. It alarms the patient at first ; it produces a condition of anxiety and trepidation. This apprehension, however, ceases with its repeated occurrence, so that later it may not excite sufficient alarm to secure the rest requisite for its relief. The hæmorrhage does a good turn at times in beginning cases by impressing upon the individual the nature of his case and enforcing the necessity of treatment. Hæmorrhage is rarely profuse. It shows itself, as a rule, after or in association with a light degree of fever. Certain cases become conscious of it only on awakening. The pillow or clothing is stained with blood ; the taste in the mouth attracts attention. For the most part it is accidentally discovered as it is received in a vessel. In exceptional cases the patient is suffocated in his own blood ; the hæmorrhage is so profuse as to inundate the trachea. Other exceptional cases where the hæmorrhage is abundant but not so inundating in character literally die of loss of blood ; but, as a rule, hæmorrhage ceases under the rest and light diet of a few days, or is cut short by appropriate treatment, to return or to recur again and again in the history of the case. Hæmorrhage is not more common in tuberculosis because the blood vessels are blocked by the advance of the disease. Cases marked by hæmorrhage live, as a rule, as long as those in which there is no hæmorrhage.

Pain in the chest is a common expression of the disease. Infraclavicular pain is always suspicious ; it is, as a rule, pleuritic. The pain of intercostal neuralgia from the toxic effect of the disease is common throughout its course.

As the disease advances and the lung tissue is encroached upon, the patient becomes more and more short of breath. *Dyspnœa* belongs to all more advanced cases, from mechanical reasons, also from marasmus of the heart and muscular failures. There is a dyspnœa which belongs to the earlier history of the disease, when there is no marked consumption of the lung tissue. It is a toxic effect. It belongs, along with the excitability of the heart—*erethismus cordis*—in the earlier stages of the disease.

The *fever* continues and becomes absolutely characteristic. Suspicion of the nature of the disease in its inception is confirmed for the most part by the presence of the fever in the evening. The temperature rises from one-half to two degrees every evening, to subside again toward midnight, to show a normal or even subnormal grade in the morning. High temperatures are preceded by chills and followed by sweats. Increase in fever marks new invasion by

the organisms of pus. The chill, fever, and sweat belong to septicæmia. Sometimes the fever is high only at noon.

The prognosis is largely determined by the fever. In a confirmed case the fever rises from the normal grade in the morning to

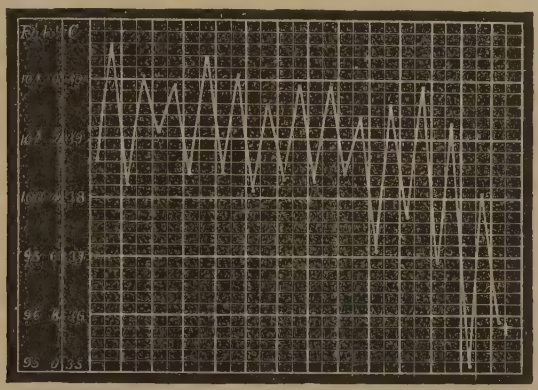


Fig. 104.—Hectic (*i.e.*, septic) fever in tuberculosis.

104° or 105° in the evening, to fall again the same night, and to show thus such abrupt elevations and descents as to constitute that

Fig. 105.—Phthisical thorax in a girl eighteen years old (Eichhorst).

see-saw record characteristic of sepsis. The fever depends not so much upon the extent of the disease as upon secondary infection by the streptococcus of pus. It does not, therefore, necessarily stand in any connection with the amount or degree of consolidation or

destruction of lung tissue, though, as a rule, high fever and rapid destruction coincide. The tubercle bacillus grows slowly. The streptococcus may rapidly flood the lungs.

Phthisis, as stated, is derived from the Greek word $\varphi\theta\acute{\iota}\omega$, to waste. It has its Latin equivalent in *consumptio,* and *emaciation* is the most characteristic feature of the disease. The people speak of an individual who is losing flesh rapidly as going into a decline, meaning thereby a subject of tuberculosis of the lungs. A loss of weight, along with pallor, chlorosis, amenorrhœa, erethism of the heart, dyspnœa upon exercise, slight fever in the evening—these are the symptoms which announce the inception of the disease ; but no one of these symptoms is so obtrusive in its further course as the progressive loss of weight. An individual may lose one-third, even one-half, his weight. The fat entirely disappears. The muscular tissue, the glands, even the bones, the nervous tissue least and last, all suffer loss of weight. Yet during the quiescent periods of tuberculosis the weight may be regained. Patients may thus increase in weight ten, twenty, or even thirty pounds. An accessible scales is a valuable adjunct in the treatment of tuberculosis.

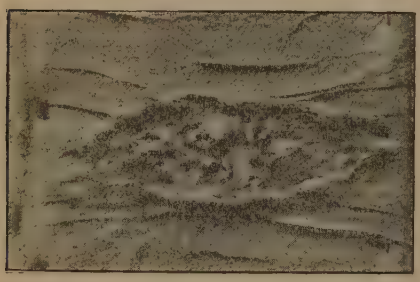


FIG. 106.—Tubercular ulcer of ileum (Med. and Surg. Hist. War of Rebellion).

Along with the fever or following the fever there is, as a rule, more or less of a sweating stage. It is noticed in the early history of a case of tuberculosis that the skin is unnaturally moist. The hands are either dry and hot or moist and hot, clammy. Tuberculous patients are very prone to show discolorations upon the skin, and especially in the region of the sternum, from pityriasis versicolor, fungi which grow in the skin on account of its increased moisture. When sweating becomes profuse it constitutes a feature of the disease, and, inasmuch as it occurs after the fever, it is known as *night sweat.* Night sweats may be so profuse as to saturate the clothing and bed linen to such an extent that the patient suffers actual cold, and the clothing must be changed in the night. Such sweating is sometimes colliquative.

It is a curious fact that these night sweats come and go in the history of a case of tuberculosis under circumstances which do not admit of explanation—that is, they disappear of themselves at times under the same conditions as existed during their appearance. Appeal is made in explanation to the action of the sympathetic nervous system, to the effect of septic toxines on sweat-producing centres.

Dyspepsia belongs to tuberculosis. Many cases, as remarked, are

preceded or announced by an obstinate dyspepsia. It is at first due to the poisoning of the blood, later, to some extent, to deglutition of the sputum. It is the history of most cases to show, during the first stage of fever, constipation. Later on, far along, nearly all cases of tuberculosis show diarrhœa. The *diarrhœa* is due to the direct invasion of the mucous membrane by the tubercle bacillus as conveyed to the intestines by the sputum. It is also due to sepsis.

The ulcers of tuberculosis are found in greatest abundance in the lowest part of the ileum about the ileo-cæcal valve, in the same region as the ulcers in typhoid fever, and for the same reason—that is, that the bacillus received into the upper part is hurried along the alimentary canal under a more rapid peristalsis until it reaches the lower part of the ileum, where movement is checked that absorption may take place, and where time and rest are offered for the action of poisonous matter or poisonous microorganisms. Ulcers are found in the intestines of tuberculous patients in ninety per cent of cases, and along with these ulcers, in correspondence largely with their abundance, diarrhœa, which becomes finally colliquative.

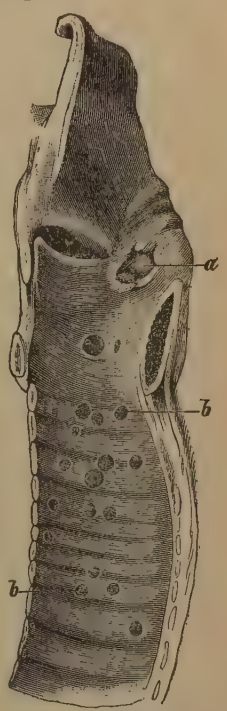


Fig. 107.—Tubercular ulcers in the larynx and trachea, seen on vertical section: *a*, deep ulcer over the arytenoid cartilage; *b*, superficial ulcers of trachea (Ziegler).

Invasion of the larynx is probably always secondary to invasion of the lungs. It is possible to conceive of a primary *laryngeal tuberculosis*, and cases have been recorded in which a post-mortem examination has failed to disclose centres in the lung. We may look, however, with suspicion upon all these cases. Tuberculosis reaches the body through the lungs, and finds lodgment, if not in the lungs, in the bronchial glands. Recent investigations show more and more the frequency of involvement of the bronchial glands. It is here that tuberculosis sleeps during the quiescent stages of the disease, and hence it irradiates as from a lair. Tuberculosis of the larynx shows no sign at first different from an ordinary catarrh. Later, however, the hyperæmia becomes more pronounced, the swelling more intense. Pure cultures are to be seen at times upon the surface, and with the erosion of tissue occur the well-known tuberculous ulcers and deformities of the disease. Tuberculous patients very commonly become *hoarse* of voice; at times, and not infrequently, *aphonic*. These conditions are explained by the hyperæmia of the mucous membrane

and the paretic states of the subjacent muscles. Later on the total loss of voice, together with the difficulty in deglutition, is accounted for by the gross destructive change. The tubercle bacilli seem to find a favorable nidus for development in the regions about the larynx, and perhaps there is no place in the body in which they revel in such luxuriant growth.

In correspondence with the progress of the disease, with the loss of substance, and the fever, the colliquative night sweats, and diarrhœa, the patient's strength becomes more and more reduced, the movements of the body more and more confined to the house, to the room, the chair, the sofa, and the bed. This progress may extend over months or years, or over the greater part of a lifetime, with exacerbations and remissions, with quiescent stages of months' or of years' duration.

During the first stage of the disease the *physical signs* are few. There is no perceptible limitation to the excursion of the chest. Some degree of emaciation may be remarked. There is no difference in mensuration, and no, or very slight, difference in percussion. But auscultation reveals the rudeness of inspiration and prolongation of expiration in the early history of the disease. A little later the movements of the chest become more limited and in advanced cases almost annulled. The breathing in these cases is chiefly diaphragmatic, abdominal.

Differences in expansion may be more readily recognized by *mensuration*. All cases of pronounced tuberculosis show a diminution of so-called vital capacity. For practical purposes it may be said that the difference between inspiration and expiration in a man of the stature of five feet eight inches should be three full inches. In tuberculosis this difference is lessened. A difference of but two and a half inches should excite suspicion. A difference below two inches points strongly to the character of the disease. *Percussion* now shows *dulness* under the clavicles. Slight shades of difference are recognized best by comparison of one side with the other. Auscultation furnishes the evidence of consolidation. There is *bronchial respiration*, bronchophony, or evidence of pleuritic effusion, or great thickening of the layer of the pleura itself. Inspection shows now marked change in the contours of the chest. The thorax is flattened, the intercostal spaces sunken. The clavicles and scapulæ stand out in bold prominence. It is the picture described by Aretæus. The absorption of fat from the body changes the physiognomy. The features are sunken. A curious condition is noticed in the fingers. The hands themselves become so thin as to be diaphanous, and the absorption of the fat at the ends of the fingers gives rise to that peculiar condition called "clubbed."

The *diagnosis* rests upon the discovery of the bacillus in the sputum. When first revealed the disclosure of the bacillus took the time of twenty-four hours to secure saturation with color. Many subsequent improvements have been made in this original process, so that at the present time the examination occupies scarcely more than fifteen minutes. The most effective means in general use at present is the so-called carbol-fuchsin test: Aquæ destillatæ one hundred, acidi carbolici crystal. five, alcohol ten, fuchsin one. A particle (of sputum) is placed upon a cover glass, covered and pressed over the whole surface by a similar glass, which is then drawn away. The glass is dried in the air, then drawn thrice, specimen side up, through a flame, whereupon it is covered by the coloring fluid hot, then immersed one minute in the decolorizing fluid—viz., water fifty, alcohol thirty, nitric acid twenty—and finally stained with methylene blue. Tubercle bacilli stand out red in a blue field. Masses of sputum should be first boiled with liquor sodæ and allowed to deposit sediment over night. While the presence of a single or distinct bacillus would establish the disease, absence of the bacillus does not necessarily exclude it, as the specimen examined might not include any bacilli. Repeated examination may thus become necessary.

Fig. 108.—Shred of elastic tissue in sputum.

Fig. 109.—Elastic tissue with epithelium and bacteria.

The diagnosis may be established, in a case at all advanced, by the discovery in the sputum of elastic tissue. For this examination no particular skill or apparatus is demanded. A morsel of sputum, preferably a grayish or reddish-yellow particle, is pressed upon the slide by the cover glass, to reveal at once, best after the addition of a drop of a thirty-per-cent solution of caustic potash, the curled fibre of elastic tissue, usually, on account of its incompressibility, near the edge of the glass.

In all other cases of tuberculosis, of the skin, glands, bones, testis, etc., as well as in all concealed, latent, or quiescent cases, the diagnosis may be declared in the course of a few days by the subcutaneous injection of tuberculin—one milligramme of the diluted 1 : 100 solution—which will produce fever in tuberculosis, but will have no effect in other diseases or in health.

The *prognosis* is determined by various factors, chief among which are the habits of the patient with regard to personal cleanliness, especially with regard to destruction of the sputum. Many patients, by neglect of these precautions, live in an atmosphere of tuberculosis of their own creation, so that there is more or less continuous auto-infection. The actual extent of invasion is a factor of importance, but, strange as it may appear, of rather secondary importance. A pure atmosphere free from the streptococcus of pus gives the best prognosis.

The continued progress of the disease is indicated best by fever, hectic. Night sweats furnish signs of more value in a prognostic way than the amount of lung tissue invaded. It must always be remembered that at any time periods of quiescence may occur, that the disease may be brought to a standstill, that even in conditions of desperate outlook improvement may take place for a time.

The condition of the heart is a factor of value, as indicated by the strength of the pulse. A feeble pulse is a bad omen. The degree of dyspnœa furnishes striking evidence. Superficial, shallow respiration indicates rapid advance. Implication of the larynx is a bad sign. Well-marked laryngeal tuberculosis gives the patient not much longer than three to six months to live.

Diarrhœa, especially if profuse or obstinate, indicative of more or less extensive ulceration, occurs toward the close of nearly all cases. The signs of marasmus in general, œdema of the feet, vertigo, more or less complete syncope, are ominous signs.

Prophylaxis.—From what has been said already, the prevention of tuberculosis resolves itself into a simple problem, to wit, the destruction of the sputum. True, cases are acquired in other ways, as by the food, milk from tuberculous cows. Tuberculosis may be introduced through the skin, but all these other ways are exceptions. The mass of tuberculosis comes through the lungs. It is no longer a question of inheritance. The theory of heredity is, as has been shown, superfluous and injurious. The prevention of the disease, as we know it, in the lungs follows as a matter of course from destruction of the sputum. Cuspidors should stand in every room and hall of houses inhabited by tuberculous patients. The cloths used as handkerchiefs should be burnt before any drying may occur. Patients should expectorate in water, and cuspidors or spit cups should be emptied twice a day. Houses inhabited by tuberculous patients should be subject to sanitary inspection when absolute reliance may not be placed upon the cleanliness of attendants. It is not necessary to isolate tuberculous patients. It is absolutely necessary to remove a child from the breast of a tuberculous mother. It is not necessary to prevent the marriage of tuberculous patients.

The prevention of tuberculosis depends upon the destruction of the sputum and the thorough boiling—*i.e.*, sterilization—of milk. All else is trivial. With these two precautions tuberculosis will practically cease to exist.

The radical *treatment* of tuberculosis implies some address to the destruction of the cause of the disease, or to the rendering of the soil of the body infertile for its growth. Search has been made for a specific ever since the time the disease was known to be a specific affection. So long as it was believed that tuberculosis was only a secondary affection consequent upon other diseases, it was irrational to look for a specific treatment. Chlorine was introduced as a specific in the time of Louis, who found it valueless; and one substance after another in materia medica, recommended as a specific, weighed in the balance, has been found wanting. All these remedies were empirical.

The treatment of tuberculosis up to the present time consisted in climate and cod-liver oil, with address to symptoms in individual cases. There is unanimity of opinion regarding the value of climate in the therapy of phthisis. Any climate which permits outdoor exercise is of value; but the value increases with altitude, and in still more marked degree if the altitude be dry. A high, dry air is best suited for phthisical patients. Climatic considerations are best fulfilled in our country in Colorado, at the altitude of about five thousand feet above the sea. Wyoming, Nevada, Montana, New Mexico, all offer points of greater or less elevation, together with the comforts of life—a *sine qua non*. There is no contra-indication to climate except that which experience may furnish in an individual case. It has been found that cases are less liable to hæmorrhage in the altitudes. Cases in which fevers are less marked do the best here as everywhere, and here as everywhere quiescent cases all improve. Many, perhaps most, recover absolutely. Latent depots are often left, to be awakened into renewed activity upon return home. Advanced cases secure the best advantage in milder climates. The islands in the ocean, the Sandwich Islands, the Bahamas, especially Nassau, the Bermudas, are sojourns at sea without the disadvantages of a ship, which is to most people, as it was to Johnson, "a prison with the additional disadvantage of danger of death by drowning." Gestation at sea was recommended by Galen. Many cases recover in the longer trips of sailing vessels or in the repeated voyages of officers, ship surgeons, etc. Mild cases, as stated, are benefited by any change of climate which permits life in the open air. The house climate in which the disease is begotten is inimical to recovery. A high, dry climate acts by increasing the respirations as well as the activity of the heart. The lungs are thus better fed with air and with blood. The air of altitudes is more pure; it is

also more dry. There is less self-infection and less infection by sepsis. The products of the disease are more rapidly dissipated.

Of all the internal remedies used in the treatment of tuberculosis, but one holds its place as having any real virtue. This remedy is *creosote*. Testimony increases as to the value of creosote. To be effective the remedy must be pure. Impure preparations contain carbolic acid, which injures the stomach. The patient must be saturated with the drug. Guttmann has shown that the tubercle bacillus will not grow in solutions of creosote 1 : 4000. Such saturation is impossible, but large doses are given with the best effect. It is administered best in mixture with equal parts of tincture of gentian or tincture of nux vomica. The patient may take five drops of this mixture three times a day in an equal number of teaspoonfuls of whiskey and water, equal parts. The creosote mixture is to be increased a drop a day, the whiskey and water a teaspoon a day up to ten, whereupon intermediate doses between meals and bedtime should be commenced and increased likewise up to ten, so that the patient takes finally ten drops in ten teaspoonfuls of whiskey and water six times a day. At this time the body is saturated. Creosote is perceived in the breath, in the exhalations from the skin, etc., and by this time the patient begins to improve. It is astonishing what change takes place in certain cases. It may be said, as a rule, that the afebrile cases do the best, but fever is no contra-indication. In many cases the fever subsides ; night sweats cease ; cough disappears ; the patient gains in weight, strength, and spirits. But not in all cases. There are many disappointments. There are cases which gain temporarily, to lose later under continued administration, and there are cases which are not benefited from the start. Harm the remedy cannot do. Cornet believes creosote acts only by improving digestion. Another explanation is offered in the neutralization of certain tuberculous toxines, or in the aseptic properties of the drug, as its name implies. It is now known that most of the symptoms of tuberculosis are due to sepsis from mixed infection. Cases in which the remedy irritates the stomach are very few. Exceptional cases may suffer nausea and aversion. In these cases the creosote may be administered mixed with the balsam of tolu in capsules, and gradually increased as before ; or the creosote may be suspended in milk. It is claimed that good effects are obtained by subcutaneous injection of *pure* creosote with *pure* olive oil, the oil having been rendered aseptic by boiling, in the proportion of one part creosote to three or four parts oil. The first injection may be five drops creosote and fifteen drops oil. The quantity is to be increased to ten or fifteen drops of creosote, with oil in proportion. The injection should be made in the back, twice daily, at a different place each time. It is attended with very

little pain. Arsenic is the next remedy, because it improves digestion and absorption.

Tuberculous patients should be fed. Where the stomach is excessively sensitive, milk with equal parts of Selters water, in wineglassful doses every hour or two, may still be retained. A gentle stimulation may be offered with a light extract of malt, wine whey, Rhine wine, etc. Debove proposed to introduce food in large quantities through the stomach tube in the process of *suralimentation*, and remarkable results were reported from this method. It is as a rule, however, unnecessary, as the appetite may be stimulated and digestion increased by diluted hydrochloric acid, tincturé of nux vomica, or liquor potassii arsenitis, so that patients may be made to eat. Buttermilk, sweet-breads, fish, beef—these are the staple articles of diet. Cod-liver oil is now made so pure as to be almost palatable. It should be given pure, not in emulsion or mixture, immediately after meals, when the taste is blunted by satiety, in conjunction with or followed by an equal quantity—that is, a teaspoonful to a tablespoonful—of good cognac, rum, or other form of alcohol.

The result of treatment by cod-liver oil and alcohol shows how much good can be accomplished by food alone. For with the previous administration of an acid, and the after-administration of a bitter, especially strychnia, along with the cod-liver oil, the duration of the life of the consumptive has been fully trebled.

In combating the special symptoms the treatment of fever merits the first consideration. We encounter here at once the problem of therapy. A successful treatment of the fever means a successful treatment of the whole disease, and nothing convinces the physician more thoroughly of the futility of radical therapy than the attempt to subdue or keep subdued the fever.

The hectic of a day can be held in control by antipyretics, and the fever of the disease may be subdued for several days, or even for a week or two, by the judicious use of the milder remedies of this class. Where there is, along with the fever, irritability of the nervous system, anxiety, and exhaustion, it is best to use phenacetin in two- to five-grain doses three or four times a day, in combination with alcohol, sherry wine, etc. The excessive fever of the evening may be prevented or subdued by a large dose of quinine, ten grains, three to five hours before the period of maximum temperature, but this remedy gives such distress that it is sooner or later abandoned. Salicylate of soda, salicin, or salol may substitute it in equal dose, or in divided doses, five to ten grains every three to six hours, with perceptible but less marked effect. The salicylates have also their discomforts, which sooner or later more than compensate for their virtues; so that the treatment of the fever of tuberculosis in the long

run resolves itself into the general treatment of the disease, especially by creosote.

Night sweats, if moderate, may be let alone. They require treatment only when profuse enough to require change of clothing in the night or to exhaust the patient. Remedies to control night sweats should be used in the following order: Sponge baths with hot, boiling, water. A hot general bath. A solution of atropia, one grain to the ounce; begin with a dose of three drops; increase on the following nights to four, five, or six drops, or until there is brought about dilation of the pupils or dryness of the throat. Camphoric acid, twenty to thirty grains in capsules at bedtime. Agaric acid or agaricin, one-eighth to one-quarter grain two or three times a day. Chloral, five grains, with a tablespoon of whiskey or a dessertspoon of brandy to counteract its depressing effect. The end will be accomplished with some one of these remedies.

Hæmorrhage, if slight, or especially if frequently repeated in the history of the patient, calls for no treatment by drugs. In all cases the patient should go to bed. Hæmorrhage demands absolute rest. More continuous or profuse hæmorrhage calls for the use of atropia, one grain to the ounce, in dose of two to four drops every two to six hours up to toxic effects. Quinine, in five-grain dose at intervals of two to four hours, subdues the fever upon which the hyperæmia and hæmoptysis seem at times to depend. An ice bag may be put over the region of the heart to slow down its action. Tincture of aconite in drop dose every hour has been recommended for the same purpose. A persistent hæmorrhage calls for the subcutaneous injection of ergotin or sclerotinic acid in half-syringeful doses every half to two hours. Certain individuals learn to check hæmorrhage by swallowing a teaspoonful of salt, through reflex contraction.

Cough in some degree is salutary, for patients literally expectorate the disease with the sputum. Some cough should, therefore, rather be encouraged than checked. The cough upon rising is of especial value in this regard. The cough which is so excessive as to lead to the evacuation of the stomach, or so harassing as to prevent sleep at night, calls for treatment. The same remark applies here as to fever, that the radical relief of cough is the cure of the disease. Patients often say, feeling their improvement, if they "could only get rid of the cough" they would be well; and so they would, but the cure of the cough implies, of course, the cure of the disease. Hence the best remedies for cough are creosote and tuberculin.

Cough which begins to be excessive may be relieved by apomorphia, to which there may be added very small doses of morphia. The bromides, in dose of ten to fifteen grains, may alleviate the cough, as a rule, however, at too much expense to the stomach.

Chloral in dose of five grains, especially if associated with alcohol, is a safe and pretty sure remedy for the night cough of tuberculosis. It counteracts also night sweats and insomnia. Later it loses its effect. It should never be given in dose sufficient to bewilder the patient or weaken the heart.

In the effort to keep away as long as possible from opium, resort may be had to codeia, which may be given, with cherry-laurel water or bitter-almond water, in doses of one-sixteenth to one-eighth or one-quarter of a grain. Sooner or later we must come to morphia. Opium in combination with benzoic acid and camphor, as we find it in paregoric, in fifteen- to thirty-drop doses, may be used at first. Some of the evil of opium is obviated by the use of the deodorized tincture. An intelligent patient in the practice of the author labelled his bottle of laudanum the tincture of hope, on account of the long (years) relief it gave. The fear of the opium habit is not to be considered in this disease. No evil is so great as tuberculosis. The evil is not the fear of the habit, but the disturbance of the digestive system. Opium seems to foster tuberculosis, hence resort is had to the use of it about the time when all hope of recovery is being abandoned. At the same time it must be admitted that opium with its shield may be called into use earlier since the day of creosote and tuberculin. Opium alone is bad practice. Judiciously employed in connection with attempts at radical relief, it is not bad practice.

In gastric catarrh dyspepsia is best avoided or relieved by regulation of the diet. Dyspepsia, which precedes the disease for months, is brought under control by diluted hydrochloric acid, ten to fifteen drops in a wineglass of water before meals. A powder of pepsin after meals helps it. A large wineglass of good malt, bitter or sweet according to taste, preferably bitter for most people, also assists it. Let medicated malts be avoided, and let all medicaments be administered separately. The stomach tube should be used early and often.

In acute miliary tuberculosis, or phthisis florida, the stomach must be handled with great care. The patient may take at first equal parts of sweet milk and some alkaline mineral water, at the very first perhaps preferably the German Selters water. In spring and summer buttermilk is a most excellent drink; it is never so good in winter. Sips of water excessively hot relieve nausea and vomiting of most acute infections. Milk may at times be taken boiling hot when ungratefully rejected in any other way. *Per contra*, certain cases are relieved by cracked ice, lime water and milk, or a pinch of soda in milk. Selters water may be had fresh from siphon bottles; most of it as we get it is unfit for drink. The diet may be brought up gradually through the soups without fat, and fresh oyster juice, to the white meat of sweat-bread, fish, or fowl. Rare beef should be

introduced as early as possible in the dietary of phthisis. Rare is as good as raw beef, and is infinitely more palatable. It may be chopped fine and made into patties, browned upon the outside. To get the nourishment of beef the meat must be swallowed. Eggs may be used at first only when diluted, as in soups or with hot water or hot milk. Though nutritious, egg in substance is not easily digestible. Vomiting due to indigestible matter is best relieved by washing out the stomach with hot water, preferably with the stomach tube. Creosote with tincture of nux vomica is a most valuable remedy in the vomiting of phthisis. Patients under the creosote treatment improve as to the stomach at once. Cherry-laurel water or bitter-almond water, with or without a half-grain or a grain of sulphate of zinc, succeeds in some obstinate cases. Bismuth or powdered charcoal sometimes suffices. A very potent remedy is chloral in three- to five-grain dose largely diluted. A mustard plaster over the epigastrium is not to be despised.

A light diarrhœa may be allowed to run, and may be regulated by the diet. In such a case milk is an important element, especially in connection with lime water, one-quarter; animal food. A more obstinate case would call for bismuth, ten or twenty grains at a dose after meals. It is helped at times by the addition of salol, five grains to each dose; or ipecac, half to one grain to each dose; or Dover's powder, one or two grains to each dose. A suppository containing a grain of opium at bedtime relieves the case for the night. A time-hallowed remedy is the tincture of opium five to seven drops, diluted hydrochloric acid five drops, camphor water a tablespoonful, every two to six hours. Patients under creosote do not suffer so much as others from diarrhœa.

Pain seldom calls for treatment. Intercostal neuralgia is combated best by quinine, salol, phenacetin, or salipyrin. Pleuritic pain is often relieved by dry cups, hot fomentations, a hot-water bag, preferably a large flannel wrung out of boiling water and put about the whole chest. Counter-irritation with tincture of iodine or with croton oil is of some use. Belladonna plasters give some relief. They are always unsightly, sometimes uncomfortable. They accumulate dirt and interfere with the examination of the chest.

The discovery of *tuberculin* established the first real epoch in the treatment of tuberculosis, as it constituted the first actual address to its cause. In beginning cases it dislodges hidden depots of the disease and makes manifest secreted centres. Thus it frequently makes a diagnosis which could not be established without it. As a therapeutic agent tuberculin has stood the fire of trial, so that its value may now be definitely stated. The use of it is contra-indicated in hectic and hæmorrhage, and in serious affection of the intestinal

canal—conditions due to sepsis, and best controlled, if controllable at all, by creosote and cognac. Tuberculin cures only pure tuberculosis. It is therefore of especial value in incipient cases of lung disease, before sepsis has set in, and in deep-seated or secreted, latent cases of gland and bone affection. In these cases it soon puts a new phase upon the disease. Cases of anæmia, amenorrhœa, dyspepsia, cryptogenetic fevers, "colds," bronchial catarrh, so-called rheumatism—in reality beginning bone caries—recurrent or obstinate laryngitis, or other of the multiform manifestations of tuberculosis, whose real nature was only disclosed perhaps by tuberculin, gradually yield under its continued and judicious use. The beginning dose should be small—one-twentieth to one-tenth milligramme—and gradually increased, avoiding fever, slowly at first, more rapidly later, up to ten centigrammes. The remedy should be introduced subcutaneously about the back of the trunk, not oftener than every other day, and always in the morning, that the effect upon the temperature may be studied during the day.

Tubercle bacilli are distributed from the lungs and intestines universally over the body, but find fertile soil only in certain organs or tissues, as in the lymph glands (scrofula); serous membranes (tubercular peritonitis, pleuritis); brain, meninges (tumor, basilar meningitis); bones and joints, vertebræ, knee and hip (Pott's disease, white swelling, bone caries, morbus coxarius); testicles (orchitis); skin (lupus), etc. The recognition of the fact that all these different diseases depend upon the same cause is one of the great acquisitions of the discovery of the tubercle bacillus. The muscles, mucous membrane of the stomach, duodenum, bile ducts, and urethra are sterile soils.

Inundation of the blood and body after erosion into blood and lymph vessels (thoracic duct) leads to acute attacks or exacerbations (miliary tuberculosis, phthisis florida); arrest of development, generally after destruction of tissue, to overgrowth of connective tissue with cicatrization and shrinkage (cirrhosis), or to caseous degeneration with subsequent softening and formation of cavities (vomicæ). The lesions of tuberculosis outside of the lungs, larynx, brain, serosæ, and intestine belong to the domain of surgery.

Tubercular Meningitis.—Guérin and Guersant in 1827 first set apart and distinguished tubercular from simple meningitis. Because of the eruption of tubercles in nodular form they called it the granular meningitis; and because it was found localized at the base of the brain it soon came to be known as basilar meningitis, in distinction again from the simple form which affects the covering of the whole brain and is seen in greatest intensity at the convexity. The

knowledge that basilar meningitis is a part of the general process of tuberculosis is an acquisition of much more recent times, but the disease was recognized as distinctly tubercular (1839) long before the direct cause of tuberculosis, the bacillus (1882), had been disclosed.

Etiology.—Tubercular meningitis is never a primary disease, nor are tubercles ever first deposited at the base of the brain. Meningitis is a part process, a localization, a migration, a colonization of an overflow from elsewhere. Post-mortem examination reveals the primary seat of the affection in some other part of the body, in one of the avenues of entrance to the body. Tuberculosis has its seat first in the lungs. The expression of the disease in the lungs may be slight, transitory. It may have disappeared altogether at the time of the examination. The lungs may show little or no lesion. Meanwhile the cause of the disease, the Bacillus tuberculosis, will have penetrated the lung substance and become lodged in the bronchial glands at the root of the lungs. Many of the victims of tubercular meningitis show the presence of tubercular glands in the neck. It is not uncommon to have observed a chain of enlarged lymphatics above the clavicles and in front of the sterno-cleido-mastoid muscle. These glands are only outposts of more extensive internal affection. Exsections of these glands would not remove the disease or the liability of subsequent extension. It may be assumed, though the connection has never been so distinctly traced, that in some cases the affection arises from the mesenteric glands—that is, from intestinal tuberculosis. Somewhere or other there must have been in the body a depot of tuberculous matter. Sometimes there is to be found tuberculosis of the lungs, sometimes affection of the vertebræ, Pott's disease, intestinal tuberculosis, orchitis, hip-joint affection, so that the meningitis, when it occurs, though it may seem to supervene suddenly, is only an episode in the course of tuberculosis and in the life of a tuberculous patient. Most of the children affected come of tuberculous stock, or live in an atmosphere contaminated by the disease. The evidence of local infection may be so well concealed as to have been overlooked, so that the outbreak in the brain is often an ugly surprise.

Symptoms.—There may usually be elicited in the study of a case a history of a preceding bronchial catarrh, marked by a *cough*, distinguished by its obstinacy to treatment, its aggravation and remission, its frequent recurrence. Instead of a bronchial there is sometimes an *intestinal catarrh* with the same history. The child is hence often more or less emaciated, easily fatigued. There is thus usually a long train of *prodromata* preceding distinct evidence of the disease.

Cases distinguish themselves as *cerebral* from the start, or as *gastric* from the start. In the cerebral form there may be observed

more or less psychical change. The *disposition* of the child *is altered.* It is easily affected, becomes *peevish, fretful, irritable,* soon loses interest in its play, may no longer be so readily diverted, seems to be seized in the midst of its occupation with a *kind of abstraction,* loses itself, as it were, for a time, gazes into vacancy, resumes its occupation with indifference or listlessness. Perhaps at this early period it may complain occasionally of *headache.* It is seen to put its hands to its head. It sleeps heavily, falls into sopor with a tendency to stupor, is longer in awakening, or is suddenly aroused, sometimes with a cry, a *peculiar sharp cry.* It grinds its teeth in sleep. These symptoms may pass unrecognized. The physician is summoned because the child is suddenly stricken with *convulsions* or *strabismus,* falls into a state of *coma* as after a stroke of apoplexy, from which it recovers consciousness *paralyzed,* usually after some more or less marked psychical disturbance.

The scene proper opens with *vomiting.* The vomiting is cerebral. It distinguishes itself by occurring suddenly, without cause, without nausea or retching. It is copious. Cerebral vomiting always excites alarm. One of the first questions that a physician asks is: "Has the child vomited?" The *pulse* offers strong evidence. The *rhythm* of the pulse becomes soon disturbed. There is a sensation as if the pulsation was to be withheld, a retardation, whereupon follow several strokes in quicker succession. In the further course of the disease the pulse becomes more and more *retarded,* though there is about this symptom no regularity. The rhythmic acts of respiration are likewise soon disturbed. In the very earliest stages of the disease the child stops to *sigh.* There is gaping, yawning, *sighing.* Later in the course of the disease the respiration becomes more and more disturbed, retarded or quickened. In the last stages it ceases altogether for a time, to reappear with a series of quicker inspirations—the so-called Cheyne-Stokes phenomena.

The *temperature* shows the same *irregularity.* It is sometimes subnormal throughout the course of the disease. The rule is that there is slight elevation of temperature at first. This sign is among the most valuable of the earlier symptoms of the disease. It is discovered, however, only by painstaking observations. To be accurate the temperature must be taken in the rectum.

Early in the disease there are also *vaso-motor* disturbances. The cheeks are flushed, often of a deep crimson, or blanched. Sometimes one side of the face is suffused, the other pallid. The color comes and goes quickly without emotional excitement. A line drawn down the surface of the body with the flat of the finger, across the forehead, down the cheek, a long diagonal over the breast,

stomach, or thighs, blanches at first, to, in the course of a few minutes, fill with blood and show itself as a crimson trace—the *tache-rouge* of Bouchut. This sign is also of value in a doubtful case. It indicates the spasto-paretic condition of the vaso-motors, and is seen also in other grave infections, as in scarlet fever.

If the *pupils* be observed closely, *inequalities* may be detected. One may be found larger than the other. One is often found more or less *contracted.* In the later course of the disease the pupils become *irresponsive* to light. Under a powerful irritation they may both be contracted, as in opium poisoning. Last of all, when effusion has taken place in the brain the pupils are *dilated.*

The symptoms which indicate the direct onset of the disease are *vomiting, headache, constipation.* The child puts its hands to its head. It tosses about in bed with pain. It has been mentioned already that there is often preliminary diarrhœa from intestinal tuberculosis. With the onset of the disease proper there is, as a rule, *constipation* which amounts to obstipation. Sharp purgatives fail to move the bowels, but with this constipation there is also, as a rule, collapse of the abdomen, so that the abdomen presents a sunken appearance, to assume a characteristic *boat shape.*

The disease is often divided into *stages*, and while there can be no systematic division of symptoms, as the symptoms of the various stages so closely intermingle, no objection can be urged against this division if this fact be held in view.

Thus the first stage—that of irritation—is marked by hyperæmia of the pia mater. During this stage occur the psychical symptoms and the vomiting, the early headache, the constipation.

Next ensues the stage of eruption of tubercles in clusters about the blood vessels or pia, with intervening opacity of the membrane itself, with, also, the accumulation of some exudation, which appears as a milky serum about the optic chiasm and the various sulci and spaces at the base of the brain. In this stage the headache becomes more severe, intense. There are convulsions, profound vaso-motor disturbances, sweatings, beginning paralyses. These paralyses affect often individual muscles—the oculo-motor, abducent, facial groups. There is ptosis, strabismus, facial paralysis, sometimes hemiplegia.

In the third stage there is free effusion. The blood vessels are occluded, the brain is compressed by fluid within and without the ventricles. The picture is now rather that of encephalitis than meningitis. The child lies in more or less constant stupor or coma. The eyes, insensitive to light or to touch, are partly filled with pus. The surface is cold and clammy, the pulse and respiration feeble, slow, and irregular. Convulsions sometimes occur, to shake with

violence this almost inanimate mass; in one of them the heart ceases to beat, and death comes to the relief of the relatives and attendants as well as the patient.

The *diagnosis* rests upon the fact that the child is tuberculous, comes of tuberculous stock, or is brought up in a tuberculous atmosphere; that the outbreak in the brain is preceded by a long train of symptoms, whereupon ensue the psychical change, the vomiting, the headache, the constipation. Later on the twitching of muscles, strabismus, convulsions, comatose state, leave no doubt. The duration is short, the whole course of the disease extending over a period not longer, as a rule, than three to six weeks.'

The question of diagnosis seldom concerns a separation of the form of meningitis. The difficulty lies with the distinction of meningitis from *typhoid fever* or *malaria*, each of which shows more or less irregularity in a child. In this separation the most reliance is to be placed upon the thermometer. Malaria shows always a more distinct periodicity, a more distinct enlargement of the spleen. It alone is really influenced by quinia. Should doubt continue, resort should be had to examination of a drop of blood. The regular elevation or step-ladder ascent of the first week of typhoid fever, and the constant plane of the later weeks, should distinguish this disease from the irregular temperatures of meningitis. The hebetude of typhoid fever is very different from the more or less periodical and paroxysmal mental disturbance of the first stage of meningitis. There are not in typhoid fever the same vaso-motor suffusions and sweatings. Meningitis is marked by constipation, typhoid fever by diarrhœa. The muttering delirium of typhoid fever differs from the excitements and convulsions of meningitis. The ophthalmoscope has revealed in very exceptional cases tubercles in the retina (choroid).

The *prognosis* is fatal. It is assumed of a case that recovers that there has been an error in diagnosis. Yet there is good authority for the recovery of exceptional cases. It is claimed that post-mortems made upon individuals who have died of intercurrent maladies or by accident have revealed lesions indicative of a pre-existent meningitis.

The hope is in *prevention*. When the health officers take charge of houses inhabited by tuberculous patients and secure the destruction of all tuberculous sputum, there will be less or no tuberculous meningitis. Meantime much more may be done than is done in this direction by education of the people by the physician.

The *therapy* is wholly symptomatic and palliative. There can be no question of the radical treatment of meningitis without address to the whole process of miliary tuberculosis, of which the meningitis is a part.

The treatment of the condition therefore implies a treatment of tuberculosis in general. The ice bag is put to the head more in deference to authority than from any possible use it might be. Nilsson claimed to have had success with the application of iodoform ointment 1 : 10, rubbed into the scalp three times a day, and brought into more constant application by the use of a cap. The bromides and chloral will relieve to some extent pains and convulsions. Resort may be had to chloroform or ether to cut the convulsions short. Morphia, internally by the rectum or subcutaneously, may give relief, will at least furnish euthanasia.

Acute Miliary Tuberculosis is distinguished by the dissemination of minute tubercles throughout a great part or the entire substance of both lungs, as well as by its general distribution over the whole body. It represents an inundation by auto-infection from some local depot, lymph gland, serous sheet, or bone deposit.

Miliary tuberculosis is distinguished by its *continuous fever*, sustained at high degree ; by the increased frequency in respiration, which amounts to *dyspnœa ;* by *pallor*, *cyanosis*, and rapid collapse. The dyspnœa and cyanosis are main factors in differentiation from typhoid fever, especially in the presence of a roseola and spleen tumor, which are common to both.

Tuberculosis of the Lymph Glands is common to all cases, but is so called only when the glands are affected visibly or show affection in signs of disease. In this regard the cervical glands are the most obtrusive. These glands appear as visible prominences, tumors, or actual deformities, to contribute to the affection commonly called *scrofula*. The tendency is toward latency with induration. Under stimulus—measles, pertussis, sore throat, or other unknown cause—the glands show signs of inflammation, usually of passive or subacute form. Thus they may undergo caseation or suppuration, and discharge their contents under a slow process of months' or years' duration, to leave finally disfiguring scars.

Affection of other glands (bronchial, mesenteric, retroperitoneal), equally common but less obtrusive, shows itself in signs of disease of the lungs, intestine, and peritoneum. Scrofula is usually attended also with conjunctivitis, blepharitis, otitis, ozæna, and various diseases of the skin.

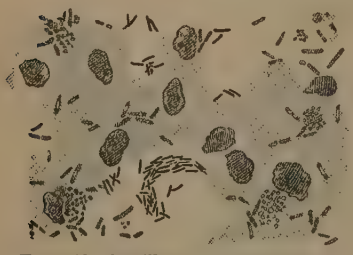


Fig. 110.—Bacillus tuberculosis in urine (Von Jaksch).

Tuberculosis of the Genito-urinary Apparatus.—Tubercle bacilli come to lodge in various parts of the genito-urinary tract, in the kidneys, including the pelvis,

the ureters, bladder, and, very rarely, the prostate gland, but not in the urethra. The disease shows itself in *dysuria* and *pain*, and the urine may contain *pus* and *blood*. The diagnosis really rests, however, upon the detection of *bacilli in the urine*. The urine is to be filtered and the sediment tested in the usual way.

Cases of salpingitis and peritoneal tuberculosis have been found to depend upon a deposit in the Fallopian tubes. A much more common localization is in the testicles, to constitute an *orchitis*, which distinguishes itself from orchitis from other cause by its painlessness and protraction. Such tumors may, however, undergo at any time rapid caseation and destruction. The disease begins in one

Fig. 111.

Fig. 112.

Fig. 111.—Tuberculous caries (stiffness) of cervical vertebræ.
Fig. 112.—Tuberculous caries (gibbus) of dorsal vertebræ (Bradford).

organ at any period of life, including infancy, and usually involves the other in the course of time. Other deposits may be usually discovered in these cases, especially in the lungs, and this deposit, as well as that in any other organ, may in turn serve as a distributing centre for disease of other organs or for general dissemination.

Tuberculosis of the Bones and Joints.—According to the observations of Alfer—1,752 cases in six years—affection of the bones and joints shows itself in the following frequency : knee joint, hip joint, vertebral column, tarsal and metatarsal bones, elbow joint, carpal and metacarpal bones. The disease (caries) is distinguished

in all cases by its sluggish character, long duration, deformity, and obstinacy to treatment.

Tuberculosis of other organs will be discussed under appropriate heads.

The *diagnosis* in all these cases rests ultimately upon the detection of the tubercle bacillus, which is the central point about which everything else connected with the subject must revolve.

It is only fair to say, however, that while the presence of the bacillus declares the character of the disease, absence of it does not exclude it, as dead bacilli dwindle and disappear. In any case the diagnosis may be established by the injection of a milligramme of tuberculin, which sets up a reaction in a case of tuberculosis.

Prophylaxis includes removal from the air of infection, or, where that is impossible, purification of the air by ventilation, destruction of sputum, general cleanliness, etc. A scrofulous child should be bathed regularly and fed substantially with nutritious diet—milk, eggs, meats, and all kinds of fruits and vegetables. The milk should not come from a tuberculous mother, nurse, nor from a tuberculous cow. Here, again, the condition may be determined at times only by an injection of tuberculin, which discloses tuberculosis at times in people, especially in milk cows, apparently perfectly healthy.

The *treatment* in every case is the treatment of tuberculosis in general, by roborant diet, fresh air, altitude, cod-liver oil, tuberculin, creosote, iodine, etc., with especial address to the especial form of the disease. Iodine is best administered to a child in the form of the syrup of the iodide, gtt. x.–xxx. in double the quantity of simple syrup, three times a day. Where the iron may be contra-indicated on account of constipation the iodide of potassium or sodium may be preferred. Five drops of the ounce-to-ounce solution—*i.e.*, the iodide with peppermint water—may be administered before meals in a wineglass of milk. Swollen glands often disappear entirely under this treatment. Hueter recommends extirpation by means of a long excision along the posterior border of the sterno-mastoid muscle, enucleation with a blunt instrument, and dressing with the iodoform tampon. It is certain that the glands, though a constant menace, remain innocuous in many cases.

Bone and joint affections may be sometimes reached by injections of iodoform. The remedy is best brought to bear upon the disease in the form of iodoformol—*i.e.*, iodoform with twenty per cent of olive oil. Boiling sterilizes as well as makes a fine emulsion of this mixture, which when injected releases the iodoform to be distributed over and about the seat of the disease. The oil is not more painful injected hot than cold. The injection, containing iodoform 3 i. each

time, should be made about once a week. Trendelenberg reports forty per cent of cures, or approximate cures, with this method.

Systematic trial should be made, in all obstinate cases, of the inunction treatment with massage. Green soap (sapo viridis) should be rubbed into the trunk and extremities twice a day for one week, then once a day for three days, after which, not before, the body may be washed clean. Remarkable results may follow this simple procedure. After failure with these means, or in connection with them, resort may be had to tuberculin in very small dose, and finally to the surgeon's knife. Speedy extirpation of an affected testicle may save the sound side, and may prevent a general dissémination of the disease.

Lastly, perfectly quiescent cases should be let alone, on the principle "*quieta non movere!*" On this principle the surgeon sometimes compromises with an abscess about the hip, and always splints the spine in vertebral caries by a plaster jacket or other fixed support. But here, as everywhere, cases must be individualized. Gland and bone tuberculosis is more apt to be a pure process than lung tuberculosis, which is, as a rule, complicated with subsequent septic infection. The apyretic is the best period for radical address by tuberculin, and cases which show paroxysmal or continually recurrent attack of fever should be subjected to this treatment. The dose should be increased from one-twentieth of one milligramme, the minimum, to ten centigrammes, the maximum quantity. The remedy should be injected not oftener than every other day, and with strict regard to the temperature, *i.e.*, to the keeping this side of fever. The tone and vigor of the body rapidly improve under the use of tuberculin, and the uncontrollable evils of septic invasion and the long, slow tortures of marasmus from later dissemination are averted in this way.

LEPRA.

Lepra; leprosy (λέπρος, scaly); elephantiasis Græcorum; German, *Aussatz* (set apart, isolate).—A chronic infection, chiefly of the skin and nerves; produced by a special bacillus; characterized by infiltration and destruction of tissue, disturbance and destruction of sensation (anæsthesia), and slow, progressive marasmus.

History.—Lepra, the famous plague of the Old Testament, was the most dreaded disease of antiquity and the most formidable foe of mankind. On account of its deformity, infectiousness, and incurability, victims of the disease were shunned and set apart. The term "leper" is still a contumely. With the advent of syphilis in the fifteenth century leprosy began to recede, to occupy finally a subordinate rôle, so that the disease is now seen in Europe only in Norway

and Sweden, Turkey, along the borders of the Mediterranean; and, in America, in the Sandwich Islands and in the southern part of our own country (Florida and Louisiana), though it still prevails in epidemic proportions in the East. The luminous period in the history of the disease was the discovery of the Bacillus lepræ by Hansen and Neisser in 1879.

Bacteriology.—The Bacillus lepræ is a slender, delicate rod, about half as long as the diameter of a red blood corpuscle. It resembles closely the Bacillus tuberculosis, and is usually disclosed in the same way, but differs from it in that it may be stained in acids, eosin, and

Fig. 113.—Leontiasis leprosa (Münch).

acid fuchsin—a fact which led to its earlier recognition. The Bacillus lepræ has been cultivated on gelatinized blood serum and cooked egg. Authorities differ regarding the possibility of inoculation of animals and the mode of ingress into the human body. The best bacteriologists deny any hereditary transmission. Lepers live for years in intimate (family) relation with others without ever conveying the disease. It is certain that the bacillus or its spores may lie latent in the body for a long time, for months or years. It is usually disseminated through lymph channels, more rarely by the blood (vide Frontispiece, Fig. 1).

Symptoms.—The soils of selection in the body are the *skin* and

nerves, but other organs, the liver, spleen, and testicle, are often visited *en masse*.

In the skin, especially of the face, knees, elbows, and backs of the hands, lepra forms masses or tuberosities, which slowly increase in size, to produce characteristic *deformity* (leontiasis) or *ulceration* with destruction. The destructive process slowly extends, to invade deeper tissues and organs. In fact, lepra may attack any part of the body; the hairy scalp and glans penis alone escape.

Nerve tissue is *irritated, thickened*, and finally *destroyed*, with symptoms at first of *hyperæsthesia and pain*, especially in the domain of the *ulnar, median, and peroneal nerves*, and later *anæsthesia*, not infrequently paralysis. Trophic change, *discolorations, morphœa nigra et alba*, and *pemphigus* are common expressions of the disease. Every invasion is attended with that rapid multiplication of cell elements which constitutes the "granulation tumor."

The *incubation* runs from three to five years (Hansen). The *course* lasts for life, which it usually abbreviates with deformities to which the patient grows indifferent.

Fig. 114.—Mutilating leprosy.

Prophylaxis and Treatment. — As the mode or avenue of invasion is unknown, and as the disease is general or constitutional when first seen or recognized, the only prevention consists in destroying excreted matter, and isolation of patients, whose lot should certainly be made as comfortable as isolation admits. Periods of latency or quiescence, even of years' duration, must not be mistaken for cure of the disease. Treatment is as yet symptomatic and empirical. Unna claims to have cured cases with the internal administration of the ichthyo-sulphate of soda and local applications of ichthyol and pyrogallic acid.

SYPHILIS.

Syphilis, *sive* morbus Gallicus (Fracastorius, 1530); pudendagra, lues venerea, pox; etymology unknown (possibly σὺς φιλεῖν, mutual love).—An exclusively human infection, of venereal origin, inherited or acquired, distinguished by a long period of incubation, two to four weeks, a primary sore at the point of inoculation, with subsequent glandular enlargement; a second stage marked by sore throat, cutaneous eruptions, and condylomata; a third stage with fall of the hair, disease of bone, and finally of internal organs.

Syphilis formerly included other venereal diseases—gonorrhœa and chancroid. Knowledge of true syphilis dates from 1493 A.D. Definite information and differentiation from gonorrhœa was furnished by Ricord, 1838. The contest between the unicists, who maintained that the varieties of venereal disease were but different expressions of the same malady, and the dualists, who maintained that each disease was separate, was decided by Ricord, who, with overwhelming proof, established the fact that syphilis is a constitutional, chancroid a strictly local disease. No other venereal disease than syphilis is or becomes constitutional. Chancroid may involve the lymphatics and produce buboes, the sore itself may become gangrenous, but chancroid is never systemic. So, also, gonorrhœa may affect the lymphatics of the groin, may extend to the bladder, in women also to the uterus, tubes, ovaries, and even to the peritoneum, it may invade the joints, but it never causes late constitutional disease.

History.—Gonorrhœa and chancroid have been known from time immemorial. Syphilis, as stated, entered Europe and was first described as a form of venereal disease about 1493. It appeared before Naples and spread through Italy with the invading French army. During the following years it raged violently throughout all Southern Europe. The primeval origin is unknown. The period of its appearance was a period of adventure and exploration. America was discovered and Africa explored. Certain medical historians derived the disease from America, but there was no history of syphilis among the indigines until it was introduced from Europe. With more reason it is supposed to have been imported from Africa by Portuguese explorers. With its first recognition it was certainly a new disease, but within ten years it spread over the whole civilized world. The filthy personal habits and the peculiar social customs of the time explain its rapid diffusion. Ricord believed it to be a transformation of glanders ; Simon considered it a form of leprosy. It is now known to be specific, *sui generis.* The confusion which so long prevailed regarding the identity of venereal diseases was partly due to the fact that two or more affections may be conveyed at the same time. It is possible at one impure intercourse to contract syphilis, chancroid, and gonorrhœa, with scabies or pediculi.

Syphilis is distinguished by its long period of incubation. The first manifestation appears in two to four weeks, usually not later than the twenty-first day after infection. Any lesion which appears before the lapse of two weeks is almost certainly not syphilitic.

Etiology.—The disease may be conveyed, aside from sexual intercourse, through the medium of utensils, drinking vessels, towels, by contact of other parts of the body, as of the lips in kissing. Phy-

sicians have become infected in the manipulation and treatment of a case, more especially in obstetric service.

Syphilis is introduced only by inoculation, whereby is required a break of the surface. Slight lacerations, abrasions, or other lesions of the genital mucosa suffice to give it entrance.

Bacteriology.—Lustgarten ascribes pathogenic properties to a bacillus much like that of tuberculosis. It is 3 to 7 μ long and somewhat enlarged at the ends. It is demonstrated with difficulty, best, according to Muschalk, in the hot Löffler solution with subsequent stain with vesuvin, when the bacilli stand out blue on a brown field. Cultivation has not yet been successful. The pathogenetic relation of this organism is not yet definitely established; for it speaks the facts that it may be found in all kinds of syphilitic lesions, and that it may be now distinguished by the carbol-fuchsin test from smegma bacilli, from which it could not hitherto be separated.

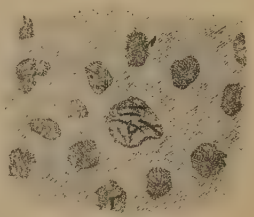


Fig. 115.—Lustgarten's bacillus of syphilis.

Hereditary Syphilis.—Either parent affected with syphilis, manifest or latent, may communicate the disease to the fœtus. The child may be affected during birth by disease of the soft parts of the mother (congenital syphilis), at conception by diseased ova or spermatozoids, or during gestation through the blood (hereditary syphilis). Further, a father may communicate the disease to the child

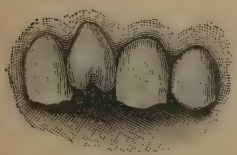


Fig. 116.

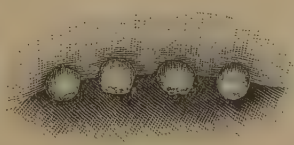


Fig. 117.

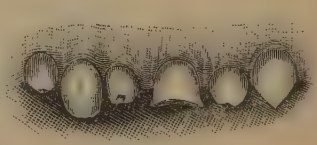


Fig. 118.

Teeth in hereditary syphilis (Hutchinson).

through the spermatozoids, while the mother escapes altogether or is subsequently affected by the child.

The fœtus thus affected may perish in utero and be discharged. Habitual abortus is frequently due to this cause or to placental syphilis. More frequently the child is carried longer and birth is premature. The child then, or later, shows evidence of the disease in feeble constitution, stunted growth (arrested development), notched teeth, etc., or in actual eruption of papules, vesicles, and scales upon the palms of the hands and soles of the feet (pemphigus and psoriasis). Coryza, caries of bone, periostitis, keratitis, are other evidences

of infection. In the vast majority of cases of hereditary syphilis the disease shows itself within three months after birth. In a small proportion, ten per cent, it may be delayed up to six months—*syphilis hæreditaria tarda.*

As the disease expires in the parents, subsequent conceptions show less and less infection, until finally children are born healthy and at term.

Symptoms.—The first sign of syphilis appears at the site of inoculation in the form of a *chancre* (from cancer), *ulcus durum,* a papule, upon the summit of which is formed a small vesicle whose rupture leaves a cup-shaped depression. The chancre is peculiar in having an *indurated base.* This induration, which is best detected

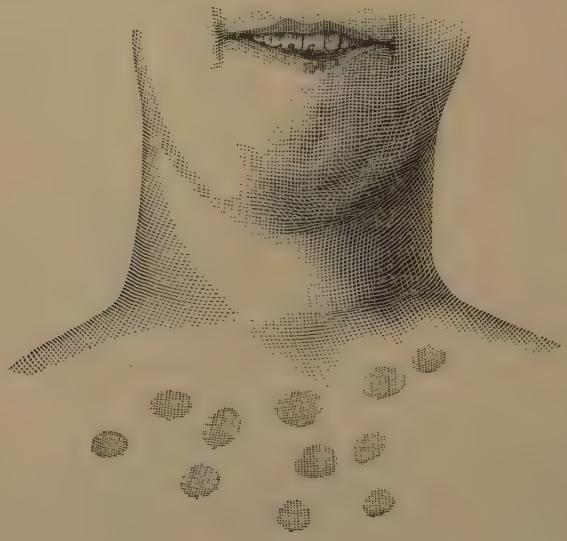


Fig. 119.—Syphilitic roseola with malformation of teeth (Keyes).

by pinching up the papule between the fingers, is almost pathognomonic. It constitutes what is called the *initial sclerosis.* The sore lasts, as a rule, at least three or four weeks, often as many months. It may reappear after having subsided, and this process may be repeated.

In the female the initial lesion is usually located upon the inner surface of the labia or on the vaginal portion of the cervix. In these situations it appears as a flat or slightly elevated sore without the distinct papular character. On account of its location and character it is frequently overlooked.

By the time the induration of the chancre is well developed there is enlargement of the inguinal glands, usually more marked in one

gland, forming the so-called indolent *bubo*. The common seat of bubo is in the groin. If the hand is the site of the primary sore, the glands back of the elbow, the cubital or post-cubital glands, first enlarge. The situation of the chancre determines the site of the bubo, in that the nearest glands are the earliest affected.

A month may now elapse without further manifestations, after which time lesions show themselves in the skin. The *eruption* upon the skin is often preceded by malaise, chill, fever, and other evidences of systemic affection. It appears as a *roseola* over the forehead, chest, shoulders, abdomen, and may be distributed as an efflorescence over the whole body.

The syphilitic roseola is to be distinguished from measles by the fact of its occurrence in an adult, by its brighter color, the broader basis of the eruption, and by the history of the case. The initial sore may usually still be found at this time. The eruption has frequently a *coppery hue*, a pigmentation, the result of prolonged irritation of the skin. It is not always seen in syphilis, and does not belong especially to this disease.

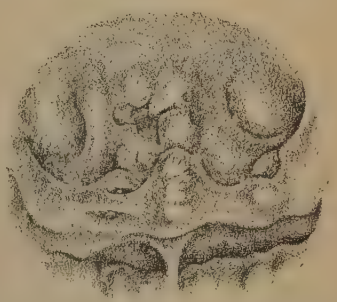


Fig. 120.—Syphilis of the larynx with great deformity.

Following the early eruption of secondary syphilis occur others representing nearly all the various forms of dermal disease—*e.g.*, small and large papular eruptions, *acne;* small and large pustular eruptions, *ecthyma*, etc. Destructive pustular, tubercular, and gummatous lesions belong to the later (tertiary) stage. Syphilis in the skin is distinguished by its polymorphism. Several different varieties of eruption may frequently be found at the same time.

By the time of the first eruption there is generally enlargement of the lymphatic glands. All the glands may become affected, and the disease is distinguished by the involvement of glands which in other diseases usually escape, as the glands behind the sterno-mastoid muscle and those behind the elbow.

About the same time lesions appear upon the mucous membrane of the throat. The throat becomes hyperæmic, especially the arch of the palate and the pillars of the fauces. There is usually some *angina*. The nose is similarly affected. Later in the course of the disease destructive lesions develop in the throat and nose. They may not remain confined to the soft palate, but may extend to the *larynx*, beginning, as a rule, upon the lingual surface of the epiglottis. Laryngeal tuberculosis, on the other hand, usually begins on

the posterior surface. No disease deforms the nose and throat more than syphilis. The *sunken bridge of the nose* is a characteristic lesion.

Among the most prominent of the lesions of secondary syphilis are the *condylomata*. These patches or plaques are the most common sources of infection, since they last much longer than the primary sore. They occur not only upon the mucous membranes, but

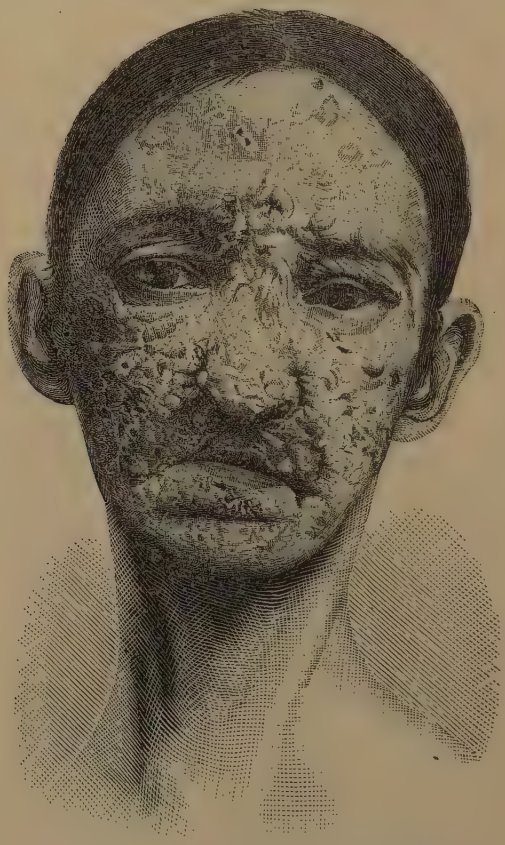


Fig. 121.—Tubercular syphiloderm of face (Hyde).

upon the skin where it is moist and subject to intertrigo, as about the vulva, nates, and under the breasts. They differ from gonorrhœal condylomata, which have a drier surface and a more raised, warty, or cauliflower appearance.

The eye is involved. There is wont to appear an *affection of the iris* during the secondary stage of syphilis, which demands immediate dilatation of the pupil to prevent adhesion to the lens. Keratitis is common later. The choroid, the retina, the optic nerve may be

affected at any time. Paresis and paralysis of the eye muscles are not infrequent.

During succeeding years symptoms may appear and disappear repeatedly.

The tertiary lesions upon the skin are chiefly pustular, ecthymatous in character. Syphilitic *rupia* is characteristic. It consists of pustules which scale over, break down, and form scales again. The crust is therefore laminated in structure and appearance, like an oyster shell. Large pustular lesions not covered in this way are called *tubercular*. They occur most frequently upon the back about the sacrum. All these lesions of syphilis destroy tissue and leave scars. They are sometimes attended by itching, which does

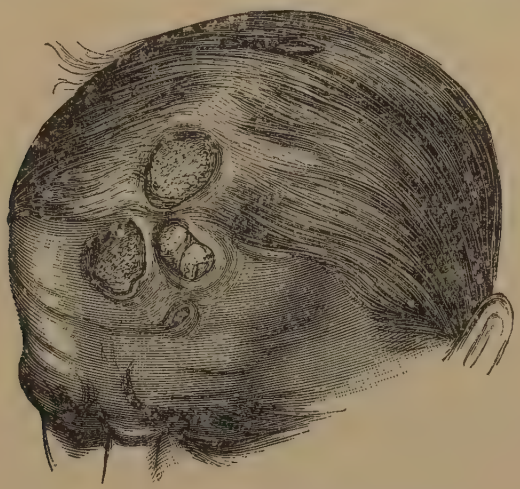


FIG. 122.—Syphilitic necrosis of cranium (Eichhorst).

not occur in the secondary eruptions. These late manifestations are not infectious or contagious.

The affection of the bones is characterized by a peculiar *nocturnal exacerbation*, ascribed to pressure from distended veins. Subcutaneous nodes develop, especially upon the sternum, clavicle, and spine of the tibia. Changes in the structure of the bones may occur in any part of the body, either in the direction of necrosis or eburnation.

Syphilitic disease of the internal organs belongs to the tertiary period. It occurs, as a rule, very late—ten, twenty, or more years after the primary lesion. It is often recognized by the fact that syphilitic manifestations have occurred at intervals during this period.

On the part of the nervous system pressure symptoms, more

especially incomplete paralysis, may arise as the result of exostosis from the cranial bones or spine. Tumors of the brain and cord may have this origin, or may consist of *gummata*, more distinctively characteristic of the disease.

A certain change affects the blood vessels, as an *endarteritis obliterans*, which gives rise to regions of softening in the brain and cord. Syphilis attacks the *nerves* themselves, especially the *third*, *fifth*, and *seventh*. The muscles, though rarely, are sometimes invaded. There is a syphilitic *myositis*, most frequent in the deltoid muscle.

The lungs are attacked more frequently in hereditary than acquired syphilis. It is often difficult to distinguish the disease from

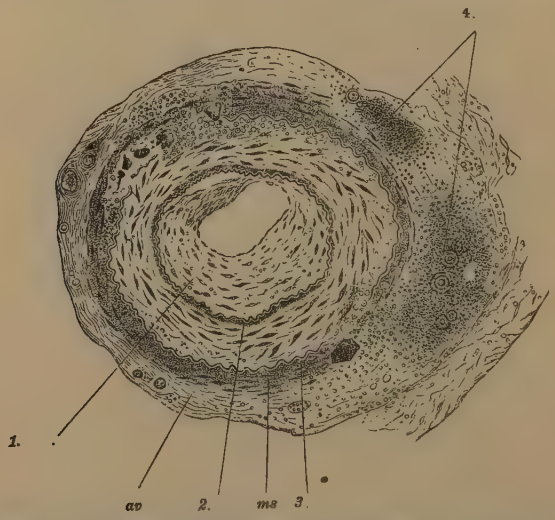


FIG. 123.—Syphilitic endarteritis (Baumgarten): 1, endarteritic growth; 2, new tunica fenestrata; 3, old tunic; 4, gummata in the adventitia; *av*, adventitia; *ms*, muscular coat.

ordinary phthisis due to tuberculosis. It is said to attack the middle portion of the lung rather than the apices. It does not give rise to cavities, and is more amenable to treatment than tuberculosis.

In the *liver* syphilis causes a form of cirrhosis, a proliferation of the connective tissue (diffuse hepatitis), compressing the vessels, and followed by all the signs of ordinary cirrhosis. Gummata frequently appear in the liver, sometimes to produce a nodular condition which may simulate carcinoma. With these lesions some external evidence of the disease can usually be found.

Syphilis causes a peculiar *sarcocele*, which may be of large size, involving the whole testicle. It is usually of slow growth and not

painful. It is distinguished from the tubercular disease by the fact that the latter affects the structure proper of the testicle, and is, moreover, usually accompanied by tuberculosis elsewhere. It differs from gonorrhœal epididymitis in the absence of fluid within the tunic.

The *diagnosis* of syphilis can usually be made by observing the polymorphism but symmetrical distribution of its eruptions, the glandular enlargements, and the changes in the bones. Suspicion is often aroused during inspection of the patient by the condition of the eyes, nasal bones, the presence of cicatrices or pigmentations in certain localities—shins—or the detection of an ozæna. The diagnosis is sometimes only definitely established by the results of treatment.

The *prognosis* is for the most part favorable. The manifestations can usually be controlled. Deep-seated lesions due to syphilis are, as a rule, more amenable to treatment than when dependent upon other cause.

Treatment.—The initial lesion is best treated upon an expectant plan. It is sufficient to make some local application, as dry calomel, iodoform, or bismuth. Excision is no longer practised.

Those patients have, as a rule, the best prospects in whom general, specific treatment is begun latest. It is not best to endeavor to prevent the secondary lesions, which are harmless. When, however, destructive changes threaten (palate, nose) it is necessary to interfere.

Specific treatment may be postponed till the disease has reached full efflorescence. This can rarely be done in practice. So great is the popular fear of the disease that it is usually necessary to begin treatment at once. The treatment, then, should be mild at the start, a syrup of sarsaparilla or mild Zittmann's decoction. Unfortunately, both physician and patient are impatient for results.

Mercury is specific for syphilis. This fact was known long ago (manna metallorum), but the drug was given so recklessly and for all the venereal diseases that some of the late lesions were often erroneously ascribed to the treatment.

The best form in which to administer mercury internally is calomel. The method of the Vienna school is as follows : One grain is given three times daily for five days ; the dose is increased one grain every five days for twenty days. One to- three-grain doses are then continued for twenty days longer.

If the bowels are too much affected they may be confined by opium. Ptyalism is to be met by the use of potassium chlorate, saturated solution, a teaspoonful every two hours. The evils of ptyalism have been much exaggerated. They are as nothing compared with the late lesions of syphilis, against which thorough treatment

offers the best protection. The best effects are to be obtained by the inunction method. A small mass of mercurial ointment, a piece as big as the end of the little finger, is rubbed between the hands, as a barber rubs hair oil before applying it, and is then applied at bedtime with friction for five minutes to the body in the following order: Forearms, arms, chest, abdomen, thighs, legs—one part each night, to avoid eczema. The body should be bathed but once a week.

The treatment should be continued for weeks or months, or up to slight ptyalism. Thereupon mercury should be given in small dose, as the biniodide gr. $\frac{1}{16}$ in pill, one to three times a day for a year or two, that the remote evils of the disease may be avoided. The iodides of potassium and sodium furnish quicker results in tertiary forms (gummata). They should be administered in milk in doses of ten to thirty grains before meals, and be kept in circulation by free libations of water (mineral waters). Iodine and mercury may alternate as remedies in the treatment of syphilis, which should be continued, with intervals of rest, for fully two years. Thus only may the patient certainly escape the terrible remote sequelæ of syphilis—amyloid change, locomotor ataxia, brain softening, etc.

CHANCROID.

Chancroid (like chancre); ulcus molle, "soft sore."—A specific (venereal) sore which appears, in *twelve to twenty-four hours* after infection or inoculation, about the frenum or other portion of the glans penis, as a red spot, which is elevated into a papule and converted into a vesicle in the course of another day or two. The vesicle ruptures to leave an ulcer with sharply defined, often overhanging borders, and a ragged, *profusely suppurating base.* The chancroid is always *inoculable*, in the ape as well as in man, to reproduce itself on any broken surface of skin or mucous membrane. Hence, by auto- or reinoculation, chancroid is often multiple. It often infects neighboring lymph glands, and is a common cause of the rapidly *suppurating bubo.* Under bad surroundings and in depraved constitutions it may spread to form more extensive and destructive lesions, phagedenic (serpiginous) or gangrenous in character; yet it is always a local process, and is never followed by signs of infection of the blood. These two features, the rapidity of onset and local confinement, distinguish the chancroid from the true chancre (syphilis).

The *treatment* is simple. If seen early it should be destroyed, best by fire—galvano-cautery, Paquelin's thermo-cautery, ferrum candens; or where from any reason this procedure is impracticable, by strong caustics—caustic potash or the zinc chloride in stick. Nitrate of silver is too superficial; it does more harm than good, in that it

only adds to the irritation and favors the development of buboes. Fuming nitric acid, applied with wood (match), is very effective. After the first few days the treatment must be mild. The surface should be thoroughly cleansed and dusted with iodoform as the best remedy, or, next, with dermatol, or calomel or bismuth. Sometimes it is best to use these remedies in the form of an ointment rubbed up with vaseline or lanoline, sometimes as a wash (black wash), or sublimate solutions 1 : 1000–5000.

Buboes at the start may sometimes be aborted with an ice bag; later they must be poulticed and freely incised. Rest in bed is the best remedy.

GONORRHŒA.

Gonorrhœa (*γονή*, seed, semen); blennorrhœa (*βλέννα*, mucus, *ῥέω*, to flow), from ancient erroneous views of the nature of the discharge; urethritis specifica; clap; German, *Tripper*.—A venereal infection of the urethra, caused by a special micro-organism, the Gonococcus, and characterized by dysuria with discharge of pus, adenitis (bubo), condylomata, sometimes by affection of the prostate, testicle, bladder, kidneys (pyelitis), Fallopian tubes (salpingitis), and occasionally followed by inflammation of the joints (gonorrhœal rheumatism).

History.—Gonorrhœa dates from the most remote antiquity. The Jews were very well acquainted with the disease, and they, with older nations, practised circumcision in prevention of it and in protection against it and other evils (balanitis). The museum at Naples exhibits catheters and dilators (bougies) exhumed from Pompeii. Syphilis on its appearance was known to be distinct from gonorrhœa, but was later, after Hunter's unfortunate double inoculation of himself, confounded with it, to be only finally dissociated by the more extensive observations of Ricord (1838). The Micrococcus gonorrhœæ was discovered by Neisser in 1879.

Etiology.—Gonorrhœa is contracted in impure sexual intercourse by the introduction into the urethra of a specific cause, a particular micro-organism, which may be thence disseminated to any part of the genito-urinary tract. The disease has therefore a very wide range, and is wont to secrete itself in some recess or lacuna of the posterior urethra, prostate gland, Fallopian tube, as a malady often of years' duration (gleet, oöphoritis, etc.). Intense or protracted inflammation, heroic treatment, as with concentrated injections, may develop stricture of the urethra with its attendant evils. Lack of cleanliness, or careless manipulations, may convey the discharge to other mucosæ, as to the anus (condylomata) or eye (conjunctivitis). The eye, more rarely the vagina, of the new-born child may be infected during birth (conjunctivitis, blennorrhœa neonatorum).

The disease is most readily contracted with filthy habits, and is favored by conditions which retain secretions—phimosis, hypospadias, balanitis, etc. The tougher mucosa of the vagina is more resistant, so that females are less affected, or, while actually containing the virus to convey the disease, may themselves escape all infection.

One attack predisposes to others, which are, however, aside from complications, successively milder as a rule.

Bacteriology.—The Gonococcus is a diplococcus, apparently composed of hemispheres separated by an equatorial zone. It is found in gonorrhœal pus in association with other pyogenic cocci, from some of which it is differentiated with difficulty. It grows on blood serum as a thin, yellowish-gray coat with smooth surface, only at high temperatures, and speedily perishes. It takes the color of the

Fig. 124.

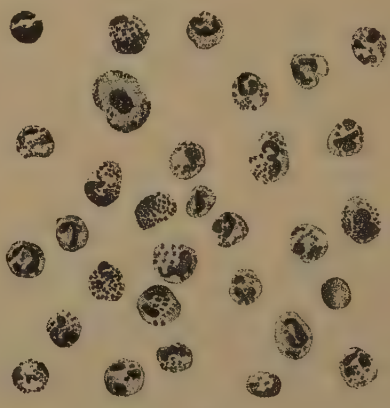


Fig. 125.

Fig. 124.—Gonococcus (Sternberg) : *a*, pure culture ; *b*, in pus, and *c*, in epithelial cells.
Fig. 125.—Gonococcus in pus cells.

aniline dyes, and gives it up under the Gram method. It is found incorporated in pus cells, as well as free in the matter discharged (vide Frontispiece, Fig. 5). It is found in the tissue of the urethra, incorporated in as well as between the epithelial cells and leucocytes. It has been traced, throughout the whole range of the disease, in the prostate, testicle, Fallopian tubes, perimetritic processes, and joints, and in the eye as the cause of a specific acute conjunctivitis and of a specific chronic trachoma.

Symptoms.—The *incubation* is two or three days, at the end of which time tingling, then burning, and later *scalding sensations* are felt in the *urethra* on passing water. The under surface of the penis (urethra) is tender ; the lips of the meatus become tumid, red, and dry, or stick together with glutinous mucus. *Erections* assert

themselves, especially at night, to produce excruciating pain and distress with deformity (*chordee*). In the course of a day or two muco-purulent matter, and later *pus* itself, *is voided*, at first with the urine, later more or less continuously, or may be at any time more freely expressed. In the height of the average case there are fever and general distress. Bad cases may be marked by destruction of tissue, erosion of the capillaries, with discharge colored by blood (Russian clap).

In certain cases infection travels along the lymphatics to reach and inflame the nearest *glands in the groin*, a chain of which constitutes a painful, indurated mass, filling the groin on one or both sides, and putting a stop to locomotion. In other cases the disease extends to involve the posterior urethra, pars prostatica, vas deferens, and *epididymus*, which swells with great pain and effusion into the tunica vaginalis (acute hydrops). Moist surfaces of mucous membrane or skin suffer maceration and irritation, with hyperplasia of papillæ, to produce the warty or cauliflower *condylomata* so common on the glans penis and not uncommon in the perineum. A more acute inflammation of the prepuce, as produced especially by lack of cleanliness, retained secretions, or by fissures from retraction, may result in phimosis or paraphimosis.

In certain cases the clap involves the posterior urethra in due sequence, usually in the course of the second or third week, to produce *posterior urethritis and prostatitis.* In certain other cases the posterior urethra and prostate are seemingly involved first, the disease having been latent at the fossa navicularis and pars pendula. In either case, whether with evident or absent discharge, there is *dysuria*, with more or less constant desire to micturate, often with sudden stoppage of the flow from spasmodic contraction of the bulb. Perturbations in the psychic sphere, irritability, dejection, emotional disturbance, *hysteria virilis*, along with *insomnia*, *headache*, *priapism*, occur with this complication, which is very much more frequent than is commonly known.

Involvement of the glands of Cowper, usually not before the third week, is revealed by a sense of weight and pain in the perineum, with the formation of a tumor in the line of the raphe under the skin, which is movable above it. The tumor may recede by resolution, or continue to enlarge to involve the skin in a suppurative process, and discharge itself externally with relief of previous distress, or internally with the bad signs of infiltration of urine and the formation of fistulæ.

Peri-urethral and prostatic abscess, purulent cystitis, pyelitis, subsequent stricture of the urethra, are not uncommon complications. Women are affected with vulvo-vaginitis, vaginitis (leucorrhœa),

metritis, oöphoritis, salpingitis, sometimes with peritonitis, as the result of gonorrhœal infection, much more frequently than is commonly believed. In this way gonorrhœa is a frequent cause of *sterility*.

Gonorrhœal *rheumatism* attacks most frequently the knee joint, one or both, and one joint rather than a number, usually late in the history of the disease, and distinguishes itself by its sluggish, passive character (hydrarthrosis) and exceeding obstinacy. The heart is not, or is only very rarely, affected.

Duration, Prognosis.—Gonorrhœa usually lasts, aside from complications, two to four weeks. It may be terminated earlier by felicitous treatment, or may by bad treatment or by complications (prostatitis, salpingitis, etc.) be protracted to constitute a lifetime malady. The *prognosis* of urethritis is favorable; that of the complication depends upon its nature. The disease is often very obstinate and shows constant tendency to recur. On the whole, though apparently a simple local affection, gonorrhœa is, on account of its complications, more destructive of comfort, more defiant of treatment, and absolutely, in the long run, more dangerous to life than syphilis. But it is not so insidious and treacherous as syphilis, and hence is not so much feared or loathed.

The *prophylaxis* is purity and cleanliness. The eye affection of infancy is best prevented by vaginal irrigations with a weak sublimate solution 1 : 10,000 before labor, and washing out the eyes immediately after birth with a solution of nitrate of silver in distilled water two per cent.

The *diagnosis* is in most cases easy. The history is sometimes a help ; often, on account of misrepresentation, a hindrance. The urethritis with dysuria and discharge, subsequent adenitis or epididymitis, distinguish gonorrhœa. Urethritis from other cause, so-called simple urethritis, supervenes at once and shows very slight discharge of very short duration. Adenitis from other infection (strain, muscular fatigue ?) has different association—*i.e.*, has no discharge or dysuria.

The diagnosis rests absolutely on the discovery of the gonococcus, which is recognized (1) by its form as a diplococcus, twin bodies with the straight or concave edges apposed like the halves of a grain of coffee ; (2) by appearance in numbers, never as a single pair ; (3) by their incorporation or enclosure in the protoplasm of the pus cells, as well as by occurrence free, *i.e.*, between the cells ; (4) by the affinity for the basic aniline dyes ; (5) by decolorization under absolute alcohol and under the method of Gram ; (6) by difficulty of culture, which really succeeds only with human blood serum. The decolorization by the Gram method especially differentiates the gonococcus from

other simulating diplococci. The gonococcus is best displayed by spreading a thin layer of the discharge upon an object glass, which is then drawn through the flame of an alcohol lamp to fix the object, dipped for two minutes in the solution of methylene blue (Löffler), washed with distilled water, well dried with blotting paper and examined with the oil immersion, whereby the oil may be dropped directly upon the object. The gonococci are thus colored deep blue, the nuclei lighter blue, the cell protoplasm gray-blue (Finger). The micro-organism has been thus demonstrated in endometritis, conjunctivitis, and all kinds of gonorrhœal processes. It is scarce and often absent in old chronic discharge. Sexual intercourse is prohibited so long as it is present even in the single, so-called "bonjour" drop or sticky mucus seen in the morning.

The gonococcus may now be relied upon as furnishing the very strongest corroborative evidence in cases of rape, etc., though Nissen claims to have found a similar structure in the eyes of a child born with membranes intact.

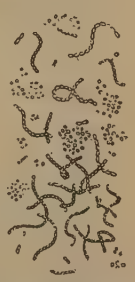


Fig. 126. — Non-specific bacteria, streptococcus and staphylococcus, found in urine.

The diagnosis of posterior urethritis, in the absence of history of gonorrhœa, is usually led up to on the basis of signs of infection not otherwise explicable, and rests chiefly upon examination of the urine, which must be always made in every case of dysuria. The urine (morning) in these cases shows fine, long filaments of mucus floating in its mass and sinking to the bottom of the vessel. These clap fibres or threads (*Tripperfäden*) come from the prostate gland and its vicinity, and are very characteristic. The first and last parts of the morning urine should be caught in separate vessels, that it may be determined whether the threads come first from the urethra or later from the bladder.

The swollen prostate may be felt with the finger as a tumid, tender mass protruding into the rectum, or offering obstacle to the passage of the catheter, which should not be introduced until all acute inflammation shall have subsided.

Treatment.—During the stage of acute urethritis the treatment should be simply expectant. The testicles should be suspended in a light bandage, the bowels should be kept open with a saline laxative —Rochelle salts, Carlsbad salts—and fluids (water, milk, lemonade, flaxseed tea, etc.) should be drunk freely; every form of alcohol must be abjured. The diet should be light. The patient should take every opportunity to rest recumbent. Sexual indulgence should cease entirely. Priapism may be prevented at night by sponging of the organ from a basin of cold water at the bedside, and excitement

allayed by a dose of the bromide of sodium or potassium, gr. xxx.–l. in a full glass of water at bedtime; or by camphor gr. iij.–v., or lupulin gr. iij., or both together, every two or three hours during the day.

The pain of micturition may be relieved by salol, gr. v.–x. every two or three hours, or by the salicylate of soda, bicarbonate of soda, āā gr. x.–xv. every two or three hours during the day. Phenacetin, gr. v.–x. every four hours, has also a soothing effect. More severe pain with priapism, or dysuria with frequent desire of micturition,

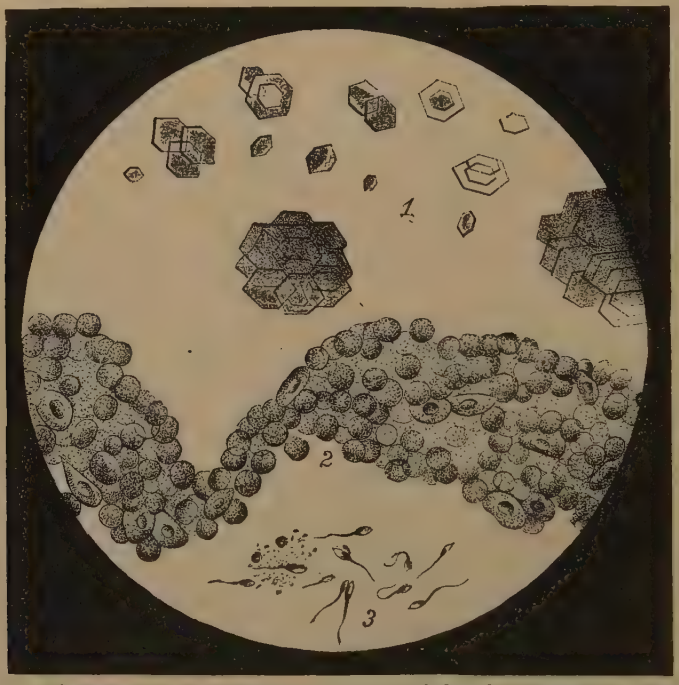


FIG. 127.—1, hexagonal plates of cystin; 2, gonorrhœal thread composed of pus and desquamated epithelial cells; 3, spermatozoids.

calls for opium, gr. i. with cocoa butter in suppository, or with extract of belladonna gr. $\frac{1}{8}$–$\frac{1}{4}$. No attempt should be made at any direct medication of the urethra at this time. Upon subsidence of the most acute stage the urethra may be addressed at first internally through the urine with the oil of copaiba or sandal wood, best in the form of capsules, each gtt. v., of which one may be administered every two to four hours. Hereupon, or later when all acute inflammation shall have entirely disappeared, but not until then, the urethra may be medicated directly with weak injections, as of plumbi acetatis gr. ss.–ij. to ℥ i., or zinci acetatis gr. i.– ℥ i., or argenti nitratis gr. i.–ij.

to ʒ iv. aquæ destillatæ, at first twice a day. Alumnol in the one- to two-per-cent solution is a bland, mild remedy; the chloride of zinc, gr. i.–ij. to the ounce, is a much more powerful antimycotic and styptic. Injections must be continued for several days or a week, at least once a day, after all sign of discharge has disappeared.

Posterior urethritis will not be reached by any ordinary syringe. The remedy, to be effective, must be introduced with a catheter, preferably with the Ultzmann capillary injector, which reaches only to the bulb and prostatic portion. By far the best remedy in these cases is the nitrate of silver, whose strength may be gradually increased from 1 : 500 to solutions of one, two, up to five per cent, prepared always, of course, with distilled water, and used in gradually increasing quantities, at first daily, later once or twice a week. Toxic headaches of extreme severity, defiant neuralgias, obstinate anorexias, fits of depression bordering on melancholy, often yield like magic to this method of treatment, which in a short time constringes the prostatic urethra, prevents the absorption of septic matter, and literally gives new tone and zest to life. Precaution must be taken to boil the instrument thoroughly before each introduction, to anoint it with glycerin, and to have the solution warm. Excessive sensitiveness of the urethra may sometimes be quickly allayed by the passage of cold water through the psychrophore for a few minutes once a day.

Cystitis is best treated by washing out the bladder with weak solutions of boric acid and later of nitrate of silver. Treatment must be continued for months. Refractory cases call for use of the endoscope.

Here, more than anywhere, is to be emphasized a maxim of Hippocrates: "*Primum non nocere!*" Here, as much as anywhere, some of the finest triumphs of medicine have been achieved.

CHAPTER V.

INFECTIOUS DISEASES—*Continued.*

MUMPS.

Mumps (Danish, *Mompen*, whence our word *mum, mumble*); parotitis epidemica; French, *oreillons;* German, *Schafskopf, Ziegenpeter.*—An acute, contagious infection, of short duration and little gravity, distinguished by painful inflammation of the parotid gland and vicinity, sometimes also by orchitis.

History.—Mumps was known from the remotest antiquity. Hippocrates mentions it, and the older physicians associated it with measles, scarlet fever, whooping cough, etc., as an affection of childhood. It was observed then, as frequently since, that the disease prevails in epidemic form, and that epidemics are wont to precede or follow outbreaks of some of the exanthemata or other affection of childhood.

Metastatic Mumps.—A special affection or infection of the parotid gland, which occurs at any age, in the course of, or a sequel to, many of the graver infections—septicæmia, the typhus fevers, puerperal fever, etc.—is set apart and distinguished from the epidemic parotitis as a metastatic inflammation. A sub-variety of this form may follow intestinal or pelvic lesions. Canstatt speaks of metastasis of mumps to the pancreas in the same sense as to the testes, ovaries, and mammæ. Schmackpfeffer reported a case wherein an autopsy revealed a pancreatitis in explanation of a parotitis, and, after a full review of this subject, Friedrich is not willing to dismiss the possibility of such metastasis, a question which must be decided in some future extensive epidemic of mumps or fortunate opportunity at autopsies. A so-called reflex parotitis is sometimes observed after catheterization of the urethra. Baginsky reported three cases which occurred in his own practice after operations for the relief of genital affections in women.

Etiology.—Parotitis epidemica, our common mumps, prefers the colder seasons of the year. Of one hundred and seventeen epidemics tabulated by Hirsch fifty-one occurred in winter, and of ninety-nine

studied by Leichtenstern forty-two were in the first quarter of the year. The disease shows also a preference for certain localities, in which it may prevail continuously, or recur with every accumulation of fresh material. Great variation is shown also in its extent or range. It remains confined to certain institutions, boarding schools, orphan asylums, barracks, etc., or again extends over, or is circumscribed to, a certain quarter of a city, or ranges over the entire city and surrounding country. Epidemics may be extinguished in the course of a few weeks, or prevail throughout the greater part of a year. The disease shows some predilection for soldiers, probably on account of close association in barrack life. Some of the best reports are furnished by the military surgeons (Bruns). It attacks males always more frequently than females, and is at times limited to children; or, again, spares no individual unprotected by previous attack, except sucklings and old people, who almost universally escape. The age of preference is from two to ten. In a house full of children mumps usually begins with the youngest, successively seizes the older children, and may afterward attack adults. Liability of males is nearly universal. The disease has often been known to attack ninety per cent of the residents or inhabitants of public institutions, schools, barracks, etc.

Mumps is undoubtedly contagious, and probably, as no other explanation seems possible, through matter expectorated from the mouth to contaminate the atmosphere in the vicinity of the patient. It may attack animals (dogs) with active salivary glands. Roth declares that third parties may carry the disease.

Mumps is probably at first an entirely local process. From the nature of the disease there can be little doubt that the cause is a microorganism which infects the blood, or which, from its nidus in the parotid gland, evolves toxines to produce fever and the other general symptoms of the disease. The evidence actually in possession goes to show that mumps originates in the mouth, and not in the blood; that the poison of the disease is conveyed to the parotid gland through the duct of Steno, and not through the blood vessels. This fact seems to have been proven of metastatic parotitis, where *a priori* reasoning would certainly derive the poison from the blood. What lends special support to this view in epidemic parotitis is the fact that the disease is found associated almost universally with stomatitis or some form of sore mouth or sore throat. Soltmann attributes the exemption from mumps of infancy and old age to the fact that the duct of Steno is too small in infancy and too atrophied in age to permit the entrance of noxious matter. One attack secures future immunity as a rule.

The period of incubation ranges from ten to fourteen days. It

may be as short as seven or as long as twenty-one days. English writers generally put it at a fortnight.

Symptoms.—The disease sets in with *chill* or shivering fits, followed by *fever* of 102° to 105°, and may often be preceded for a few days by malaise, anorexia, headache, and neuralgic pains. Coincident with the elevation of temperature is the pain, the localization of which distinguishes the disease. Shoots and stabs of *pain* are felt *at the angle of the jaw*, radiating to the temple and the ear. *The parotid gland swells.* It fills up the space between the mastoid process and the angle of the jaw, mounting over the side of the face, and extending over the cheek and down the neck with such a degree of tumefaction as at times to obliterate natural outlines. By this time there is such interference with the action of muscles and the excursions of the jaw as to close it, so that often the handle of a spoon may not be inserted between the teeth. The pain, on account of the tumefaction, tension, and interference with the circulation, always severe, is sometimes excruciating, and is of course greatly *aggravated* by every attempt at motion of the jaw and deglutition, or even at times by the *sight or odor of food*, which may stimulate the salivary glands. The inflammation extends also through all the tissues of the throat, and is manifest often in the throat and mouth by marked redness and swelling, sometimes by actual displacement or partial occlusion of the palate, pharynx, and larynx. *The lobe of the ear is lifted* and carried forward; the whole head may be pushed over to one side. The swelling reaches its height, as a rule, by the fourth day, when with the fall of temperature it begins to subside, and subsides so rapidly as to have almost entirely disappeared by the sixth to the eighth day, unless, which is not infrequently the case, the opposite side takes on the same swelling to repeat the same process. Much more rarely the affection is bilateral from the start. In such a case deformity is most pronounced. The cheeks, the jaws, the neck form a *vast tumefied, œdematous, indurated mass*, and the suffering from distention becomes correspondingly great. A peculiar characteristic, and not the less striking because somewhat comical picture, is thus presented by an individual affected with mumps.

The contagious principle or cause of mumps finds nidus also, in certain cases, in the other salivary glands, and in an organ as remote as the testicle.

The inflammation or *infection of the testicle* is the most interesting complication of mumps. The organ is usually affected after the process in the parotid has subsided, sometimes coincidently, still more rarely alone as the sole sign of the infection. It is the testicle itself which is invaded—orchitis—very rarely the epididymus

or the cord, and only after puberty. In double mumps the right testicle, in single the organ on the side of the affected parotid, is most frequently affected. Double orchitis is rare. Affection of the testicle is revealed by a sensation of weight and pain in the gland and along the cord, by fever, and sometimes by vomiting. The testicle soon becomes swollen and tender, and the scrotum is often reddened and œdematous.

Liability is not increased by the severity of the mumps. Orchitis may occur in the lightest cases. Urethritis with blennorrhœa has been also noticed with œdema of the scrotum, and in women, very exceptionally, oöphoritis with leucorrhœa and swelling of the external labia and the mammary glands.

Mumps, though considered a light infection, is liable to certain grave *complications*. Sudden deafness may set in from labyrinthine disease, and serious affection of the brain ensue from interference with the circulation or poisoning by toxines. Mental alienation, mania, and melancholia have been reported in consequence of mumps.

Other complications recorded are hyperæmia of the brain from pressure on the jugulars, meningitis, amblyopia and color blindness, conjunctivitis, laryngeal stenosis, albuminuria, hæmaturia, nephritis, etc. But it must not be inferred that mumps is a grave disease. The author, in the practice of a quarter of a century, has never seen any other complication than a trivial and transitory orchitis.

The *diagnosis* is usually easy, and is helped, in any doubt, by the existence of the disease elsewhere. The extraordinary swelling and pain, with closure of the mouth, lifting of the lobe of the ear, and torsion of the head, distinguish the affection. Lesser swelling with less pain may necessitate inspection of the throat in elimination of scarlet fever, diphtheria, or quinsy. Digital examination would detect a retropharyngeal abscess, which might extend to involve the connective tissue about the jaw. A lymphangitis, or simple adenopathy from infection of the throat—a very common affection—may be nearly as extensive and painful as mumps. It is usually seated or arises lower on the neck, has no definite duration, and is much more prone to suppuration. Resolution almost never occurs in *metastatic* parotitis, and suppuration shows itself in the course of a few days.

Mumps requires but little treatment. Confinement to the house, if not to bed, applies of course to every case attended with fever. Light diet from necessity, thin milk, soups, soft-boiled egg, custard, suffices to secure nourishment without strain upon the inflamed tissue or disturbance of the stomach. Hot emollient applications—hot oils, olive oil, cod-liver oil, cocoa butter, vaseline, etc.; flannels wrung out of hot water; hot, not too heavy, poultices of flaxseed or

slippery elm ; the lead and opium wash bound on with oiled silk, best relieve the tension and pain. Gargles of hot water with salt, repeated every half-hour or hour, are poultices applied nearer to the seat of the disease. A saline laxative, a dose of calomel, an antipyretic, quinine gr. ij.–v., phenacetin gr. iij.–x., broken doses of Dover's powder gr. ij.–iij., every two to six hours, best meet the indications and protect the patient during the short duration of the disease. Some mode of light suspension, especially in the recumbent posture, gives great relief to a developing orchitis. Faradization later will often prevent atrophy. Affections of the ear and brain call for special treatment, though little hope may be harbored of relief of a deafness which sets in over night.

Metastatic parotitis is treated in the same way, with address to the remote origin of the complication and speedy evacuation of accumulated pus.

MEASLES.

Measles (Sanscrit, *masura ;* German, *Masern*) spots ; rubeola (Sauvages), *ruber* (French, *rougeole,* red); morbilli (diminutive of *morbus*).—An intensely contagious, acute infection, characterized by coryza and bronchitis, a red-spotted eruption with branny desquamation, fever of typical course subsiding at efflorescence, with liability, mostly as sequel, to catarrhal pneumonia, sometimes to tuberculosis.

Synonyms and History.—Though existent from time immemorial, measles was first described by Rhazes, 900 A.D., in an attempt to separate it from small-pox. Rhazes noticed among the symptoms of measles " redness of the eyes with a great flow of tears, nausea, and anxiety," remarking also that the measles " that are green or violet colored are of a bad kind, especially if they sink in suddenly, for then a swooning will come on and the patient will soon die." The disease was described under the name hhasbah. Nearly all subsequent writers adopted the Italian term morbilli up to the middle of the eighteenth century, when Sauvages substituted for it or re-established the term rubeola, which the French accepted in their own equivalent of rougeole. Rubeola means something definite. It expresses a characteristic feature of the disease, in fact the most characteristic feature—the redness of the eruption. It is unfortunate that this term rubeola has been adopted by certain German writers to express that particular sub-variety, special or hybrid form of the disease known as German or French measles ; popularly, in Germany, as rötheln. So long as scarlatina would seem by universal acceptance to be the most appropriate name for scarlet fever, rubeola must be the most appropriate for measles.

Foreest (1565), the Dutch Hippocrates, first pointed out certain

distinctions between measles and scarlet fever, though the separation of the affections is usually credited to Sydenham, the English Hippocrates.

General Remarks.—The primeval home of measles is unknown. From its earliest recognition it has prevailed in epidemic form in Asia, Europe, and South America. It was imported to the United States with the first settlers, to gradually spread over it with the march of the pioneers. It reached Oregon in 1829, California and Hudson's Bay in 1846, the Sandwich Islands in 1848, whence it was carried to Australia in 1854 and to Greenland in 1864. Though the disease has now become indigenous everywhere, and individual cases are of continual occurrence in large cities, measles usually prevails as an epidemic over a wide extent of country, with intervening periods of absence. Epidemics die out in two to three months from lack of material. Measles does not hold over in sporadic cases, like scarlatina, but disappears completely, to reappear with reaccumulation of material every three or four years.

Etiology.—Susceptibility to the disease is almost universal, so that it has been said if measles had the mortality of scarlet fever the human race would have long since become extinct. The eminent contagiousness of the disease is shown in the attack of whole communities previously entirely or for a long time exempt, as in the Faroe Islands, where six thousand people were seized at once. In 1886 the disease overran nearly the whole of Russia. Thus measles makes up for its mildness by its range.

Measles prevails more distinctly in the colder months. Of the epidemics tabulated by Hirsch, three hundred and thirty-nine occurred in the colder and one hundred and ninety-one in the warmer months. The frequency of epidemics in winter has usually been ascribed to the closer contact of people at this season. It is certainly observed in cities that the disease assumes epidemic proportions with the opening of schools and kindergartens. These institutions disseminate the disease because measles is a children's disease, and a children's disease because it attacks at the earliest exposure. Escape in childhood by no means secures exemption, as is evidenced by the attack of people of all ages in isolated regions.

Measles occurs at all ages, preferably from one to five, the period of earliest exposure; rarely among sucklings, the age of least exposure, as well as of protection by protective elements in the mother's milk. It is certain that even pregnancy is no defence. The organism of measles may be conveyed by third parties and by things (fomites).

Measles may certainly coexist with other infections, with scarlet fever, with rötheln, with typhoid fever, etc., and most especially

and frequently with pertussis. An unmistakable coincidence is mentioned by Panum, who vaccinated a child in the incubative stage of the disease, both vaccinia and measles running a typical course. With the exception of pertussis, the existence of an acute disease, as a rule, postpones an attack of measles until after its subsidence. Coincidence is therefore an exception to the rule.

The micro-organism of measles escapes from the body through the nasal mucus, which, dried and infinitely subdivided, floats in and contaminates the atmosphere about—that is, in the vicinity of—the patient. Mayr certainly succeeded in propagating the disease with mucus from the nose. Canon and Pielicke found in the blood during life in fourteen cases, and in the nasal mucus, a bacillus of great difference of length, usually in groups or clusters, during the whole course of the disease. It was demonstrated by a stain of eosin-methylene-blue (concentrated aqueous solution of methylene blue, eighty ; one-fourth per cent eosin solution [in seventy-per-cent alcohol], twenty ; two to three hours' stain in the incubator). Doehle depicts protozoa as the cause of the disease.

The period of *incubation*, as determined by inoculation experiments and observations by conveyance of single cases to isolated places, is quite definitely established at ten days—that is, fourteen days before the eruption. The most indisputable observations were furnished by Panum in the Faroe Islands. It was easy in these cases to trace up the source of infection, which corresponded to the landing of a case from a ship. In all these cases thirteen to fourteen days elapsed from the day of exposure to the beginning of the eruption.

Symptoms.—The period of incubation is, in the vast majority of cases, wholly free of symptoms. Very exceptional cases show malaise or ephemeral fever, which may arise from toxines. *The stage of invasion* may be marked by a distinct chill, or, more commonly, by a series of shiverings, to be attended or followed by a *rise in temperature* to 100° to 104°, with *gastric irritation* and *nervous symptoms* in correspondence with the temperature. The fever is in many cases so slight as to be overlooked, when the disease may announce itself with more distinctive signs. After the first remission the temperature again rises with the appearance of the eruption, to reach its acme at the period of full efflorescence, and to decline as it fades away. In an average case the fever falls by crisis—that is, within thirty-six hours after the first decisive fall. During the stage of invasion characteristic *catarrhal* symptoms show themselves in the mucous membrane of the nose, eyes, throat, and bronchial tubes. These symptoms are summed under the term *coryza*. The eyes grow intolerant to light ; the conjunctiva is hyperæmic ; the nose

"runs"; the eyes, nose, and throat itch and burn—sensations but partially relieved by more or less sneezing and cough. The uvula and soft palate now show dark-red spots and later diffuse redness, the so-called *enanthem*, the first appearance of the eruption. *Bronchitis*, the result of the direct invasion of the bronchial tubes, belongs to measles as definitely as the eruption.

The *eruption proper* is seen first, as a rule, on the morning of the fourth day, exceptionally as early as the end of the third or as late as the fifth day. The eruption shows itself in "spots" (measles), usually somewhat elevated, dark-red, "raspberry" red, or tinged with blue, first upon the forehead and sides of the face. It distinguishes itself especially upon the face by coalescence and aggregation into irregular or crescentic patches with intervening islets of unaffected tissue. During full efflorescence the face seems puffed and swollen. The eruption gradually spreads downward over the neck, chest, trunk, and extremities, to cover the whole surface by the eighth day. More or less confluent on the face and neck, it gradually grows more and more discrete over the trunk, legs, and feet. Reaching the lower extremities, it begins to fade from the face. Desquamation, which is absent in light cases, is furfuraceous as a rule.

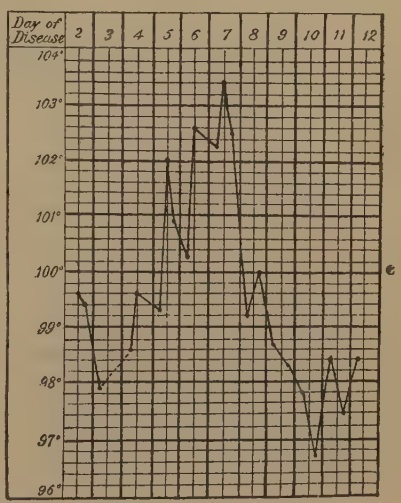


FIG. 128.—Temperature in simple measles.

The eruption reaches its height in thirty-six to forty-eight hours, the period of efflorescence, and the height of the *fever* corresponds with its duration. So soon as the fever has reached its height it begins to fall, and falls rapidly, to terminate, as stated, by crisis within thirty-six to forty eight hours. This fall of the temperature with the appearance of the eruption is so characteristic as to enable the observer often to differentiate measles in cases of doubtful eruption from simulating maladies. There is the appearance that the body struggled with the disease, and finally succeeded, as the old writers believed, in throwing it off in an eruption. But the disease is not really in the eruption. The eruption is really only a toxic reflex, like herpes, urticaria, etc. The fact is, the fall of temperature is observed, as a rule, before the eruption has reached its full height. When it is on the eve of efflorescence, as if a poison had been voided

from the blood the temperature falls rapidly. So the crisis occurs often within forty-eight hours after the appearance of the eruption, and hence measles (barring complications) is a mild disease. Hence measles is a little (short) disease. At the end of forty-eight hours after the appearance of the eruption there is in most cases no fever at all, and in many cases actually a subnormal temperature, at least in the morning. So well established is this fact in measles that the *persistence of temperature*, or the existence of an elevation of even one or two degrees on the third or fourth day after the appearance of the eruption, betokens *a complication*, which will announce itself with its distinctive signs in the course of a day or two.

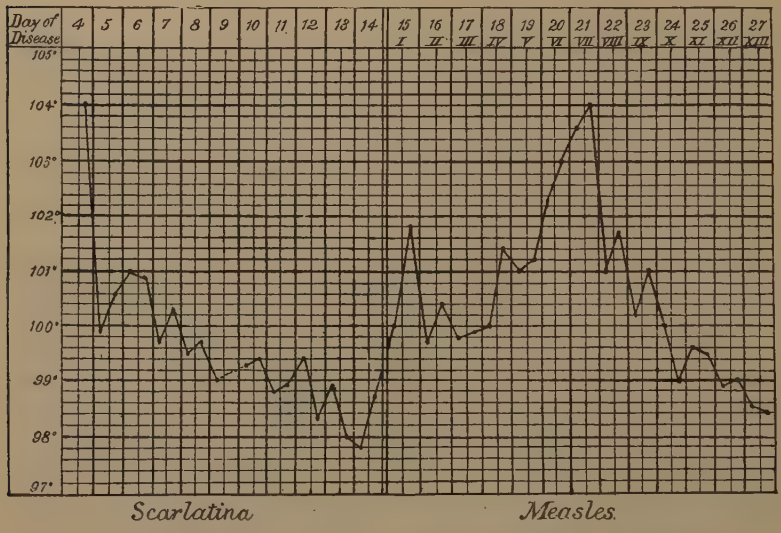


FIG. 129.—Contrast between the fever of scarlatina and that of measles (Moore).

Where records of temperature are faithfully kept complications are thus often announced before they may assume distinct proportions.

Duration and Desquamation.—The clinical history of an average uncomplicated case of measles implies thus ten to fourteen days' incubation, three days' invasion, three days' progress, and three days' decline.

Abnormities, complications, and sequelæ are of frequent occurrence. The eruption or the catarrhal symptoms may either be absent, *morbilli sine catarrho, sine eruptione*, though some eruption may be seen or found somewhere under scrutiny close enough. Blood poisoning in the stage of invasion may be so intense as to take life at the start—*rubeola siderans*. Hæmorrhage may show itself in two forms. In the more frequent but less grave form a few or many

of the spots become petechiæ. In the true hæmorrhagic or black measles, *rubeola nigra*, observed only in cachectic cases and degraded surroundings, free hæmorrhage occurs—that is, blood flows from the nose, mouth, kidneys, vagina, or intestines, and vibices and ecchymoses appear upon the surface.

Nervous symptoms may assume prominence. Headache is common, and at times severe. Invasion, especially in young children, may be marked by delirium, coma, or convulsions. True meningitis is rare. Transitory albuminuria is common, but nephritis is very rare. Very sharp attack is ushered in by anorexia, nausea, vomiting—symptoms which may extend over the period of invasion. Parotitis is very rare, but laryngismus, due at times to laryngeal enanthem, is not at all infrequent. The picture of *laryngeal stenosis*—sometimes as the result of a true croup (diphtheria), more frequently of a false croup (laryngismus stridulus), sometimes as evoked by a spot of hyperæmia on an exquisitely sensitive surface, which may be seen and treated under the laryngoscope—presents itself occasionally in the course of the disease. *Noma*, a gangrenous affection of the mouth or vulva, is an ugly complication in cachectic cases or under exceptionally degraded hygienic surroundings; it is fortunately a rare complication, but measles (Woronichin) is its most frequent cause.

Catarrhal pneumonia is the complication most frequent and most feared. It is recognized by rise of temperature, frequency of breathing, increase of cough, dyspnœa, with the physical signs of this disease. Latent *tuberculosis* is brought to the surface by an attack of measles, as a rule. Hyperæmia of the bronchial tubes and glands excites quiescent bacilli to quick and active growth, or renders fruitful a soil previously sterile to this disease. Above all other diseases, as stated already, measles liberates tubercle bacilli from bronchial glands. This is probably the true relation of these diseases. The primary infection is a thing of the past. Penetration to the bronchial glands has been favored by coddling, by the house climate, by various medications, by the administration of cough mixtures, opiates, under the cover of which the disease has secreted itself in the recesses of the lungs—to wit, the bronchial glands. Measles, with its hyperæmia, its bronchial and pulmonary congestions, irrigates the soil, swells the glands, and arouses dormant or quiescent seed into active life. Ziemssen long ago called attention to the revelations of the laboratory with reference to cervical glands, in that they so often contain tubercle bacilli hitherto quiescent; and the same condition has been revealed of the bronchial glands, which may be called nurture soils of the tubercle bacillus.

The eruption of measles may prematurely disappear, "strike in,"

at any time, not as the cause but the effect of complications. This disappearance of the eruption with the development of a complication is, however, the exception, and not, as commonly believed, the rule. The eruption runs its course, as a rule, in spite of the complication. Complications are due to the nature of the poison, to the constitution of the individual, not, as commonly believed, to "catching cold," the fear of which interferes with one of the chief means of successful treatment—free ventilation of the sick-room.

The *diagnosis* is easy, as a rule. The prevalence of an epidemic or existence of other cases, escape of attack hitherto, are points in circumstantial evidence. Measles is differentiated from a *simple catarrh* or coryza by its higher temperature, by the enanthem on the second or third day, and by the exanthem on the fourth day; from *hay fever* by the period of occurrence and the history of repeated attacks of hay fever, as well as by the eruptions of measles; from simulating *drug eruptions*—copaiba, quinia, and the various antipyretics—by the history of the case, and the immediate supervention of these eruptions without previous coryza; from *roseola* by the more uniform redness, of lighter color, more limited range but shorter duration, with the absence of fever, characteristic of this affection—if this affection may, indeed, be specialized. Papular *erythema*, which may coarsely resemble measles in the face, is distinguished by its localizations elsewhere, upon the forearms and backs of the hands and feet, as well as by the absence of fever, catarrh, and bronchitis.

Scarlatina, rubeola, variola, typhus are differentiated in the study of these affections.

Prophylaxis is almost impossible. Sickly, debilitated, more especially tuberculous children should be removed from infected houses. The liability of infection by third persons and things is by no means so great as in scarlatina, hence the necessity is not so imperative of withholding other members of the family such a length of time from attendance at school.

The *prognosis* in general is favorable. The mortality of measles *per se* is almost *nil*. Death seldom or never occurs directly from the disease, but from complications, previous debilities, and bad surroundings. Thus, Pott found as the cause of death pneumonia and capillary bronchitis in twenty-one, and croup in three, of twenty-four cases. The mortality of the disease in hospital and tenement-house practice is quite different from that of private practice. It is not uncommon to observe a mortality of thirty per cent under bad surroundings, and the range would be still higher if it included all the incident cases of pneumonia and the subsequent cases of tuberculosis which have come to light in consequence of measles. The mortality

stands also in quite direct relationship to the age of a child, and diminishes from fifty per cent under two, to fifteen above this period. The ravages of the disease among savages, as among our own Indians, were due wholly to lack of sanitation.

The treatment is purely expectant and symptomatic. Full and free ventilation at a temperature of 70°, a night gown without underwear, light but sufficient bed covers, absolute cleanliness, water and milk *ad libitum*, supply the requisites of treatment for an average case.

Any case of fever above 103° is best controlled by warm baths, which may be gradually cooled, or by the occasional administration of phenacetin, gr. iij.–v., more especially in relief of associate nervous distress. Dover's powder, gr. ij., which is now made into a palatable syrup (gr. v.–℥ i.), is just as good, is often better than any antipyretic or any other anodyne. Burning or itching of the skin is best relieved by warm baths with subsequent anointment with vaseline or cocoa butter. Photophobia calls for smoked glasses, or shading of the eyes in the disposition of the bed or screens, rather than for darkening of the room—an objectionable procedure.

A drop or two of a solution of morphia gr. iv.–℥ ss., or of atropia gr. i.–℥ i., allays any extreme irritation of the eyes; smearing the edges of the lids with an ointment of hydrargyri oxidi flavi gr. v.–℥ ss. unguenti petrolati will prevent or cure blepharitis marginalis and keratitis. The same ointment, or simple pure vaseline or boric acid ointment, gr. xv.–℥ ss., snuffed into the nose, will generally relieve the sense of dryness and irritation in the nose and throat. The instillation of hot water or of a drop or two of the solution of atropia, gr. i.–℥ i., will often quiet earache. Evaporation from a piece of cotton saturated with chloroform, held close to the meatus, is often equally effective. Gastric distress and vomiting may require cracked ice; sips of hot water, lime water, and milk one-third; bismuth ℥ ss.–℥ i., or chloral gr. ij.–v.; rectal injections of sodium bromide gr. x.–xxx. to water ℥ ij., or of chloral gr. v.–x. to water ℥ i. Few cases of vomiting from any cause will resist chloral, if its absorption can be secured.

Nervous symptoms may call for sodium bromide gr. x.–xxx., trional gr. x, or chloral gr. v.–x. Phenacetin, gr. v.–x., may suffice for a lighter case. Hæmorrhage and prostration demand alcohol—best in the form of brandy—black coffee, turpentine gtt. v.–xv. briskly stirred in a wineglass of milk; or nitroglycerin, one per cent, gtt. i. in whiskey and water; possibly opium, best in the form of the camphorated tincture, gtt. v.–xl.; codeia, gr. $\frac{1}{8}$–$\frac{1}{4}$, may substitute morphia for more protracted use; carbonate of ammonia grs. v.–x. in milk; ergotin, preferably sclerotinic acid, one-fourth to one-half a

syringeful. The syrup or wine of ipecac, to which may be added, if necessary, a small quantity of Dover's powder, preferably in the form of a syrup, suffices to restrain any excess of cough. The following is a good prescription for a child :

℞ Apomorphinæ hydrochloratis ..... gr. ss.
Acidi hydrochlorici diluti ..... gtt. x.
Syrupi ..... ʒ ss.
Aquæ menthæ piperitæ ..... ʒ iss.
M. S. Teaspoonful every two or three hours.

Diarrhœa requires at first no control. Later, as the discharges become more abundant or colliquative, it may be restrained by bismuth, to which may be added, if necessary, a drop or two of tincture of opium. An improvement on a time-honored remedy may be written as follows :

℞ Tincturæ opii ..... gtt. xl – ʒ i.
Acidi hydrochlorici diluti ..... gtt. xl.
Aquæ camphoræ ..... ad ʒ iv.
M. S. A tea- to a dessertspoonful every two to four hours.

Broncho-pneumonia calls for stimulation of the respiratory centres as well as of the heart. These centres are best reached by baths, warm baths, with cold affusions to the head. A rapid respiration, a quick pulse, cold surface, somnolence, and delirium call for baths and baths, repeated baths with cold affusions, together with the use of the analeptics, camphor, benzoic acid, ether, musk, nitroglycerin, caffeine, and brandy.

Gangrene of the skin, noma, ulcerative processes, caries of bone, are best treated with caustics, carbolic acid, solutions of corrosive sublimate, or the actual cautery, later with iodoform. In all these cases alcohol must be administered abundantly.

Cod-liver oil, pure or with malt extract, iron, arsenic, out-door air, fresh air, for the inlander especially sea-side and mountain air, with good food, are the best reconstructives during and after convalescence.

RUBELLA.

Rubella (dim. of rubeola, from *ruber*, red) ; rötheln (dim. of *Roth*, red) ; German measles, French measles, because described by German and French observers, really first isolated by an English physician ; hybrid measles, false measles, etc.—A specific, feebly contagious, acute infection of short duration, characterized by the absence of prodromata, the presence of an eruption simulating that of true measles, faucial catarrh, and enlargement of the lymphatic glands.

The word rubella, first suggested by Veale (1866), soon met with general acceptance. The universal use of the term varicella, which

has a similar relation to variola, establishes a perfect precedent for rubella and rubeola.

History and Nature.—Bergen (1752), who described it among the roseolæ, first maintained the view that it should be separated from measles and scarlet fever; but it was reserved for an English physician, Maton (1815), to establish the individuality of the disease, as based chiefly upon the observation that though self-protective, in that one attack confers future immunity, it does not protect against either measles or scarlatina, nor do these diseases protect against rubella.

Rubella stands in relation to rubeola, not as varioloid, but as varicella to variola. It certainly differs from both measles and scarlet fever in its contagiousness, mode of invasion, symptomatology, duration, and decline. Though much less contagious than measles, and hence much less frequent, the disease is decidedly more prevalent than is commonly believed. Many cases are mistaken for measles, and most of the so-called successive or repeated attacks of measles are really rubellæ.

Etiology.—The disease is propagated by contact, also by third persons and by things. The bedding of steerage passengers has been known to conceal and convey contagion for a long time. From the nature of the disease the cause of rubella must be a micro-organism, but the specific structure has not yet been isolated. Micrococci have been observed in the blood, but without any other evidence of positive relationship. Griffiths found a highly toxic ptomaine in the urine peculiar to rubella.

Rubella occurs at all ages, rarely in infancy; seventy-five per cent of cases before fifteen, the period of greatest liability. But susceptibility to it is so much less than to measles that the majority of people escape it throughout life. Attack in adult life is much more frequent than attacks of measles, first, because the susceptibility is not so universal, so that childhood often escapes it; and, secondly, because epidemics prevail at much longer intervals. Adults have, however, immunity in high degree. Kassowitz observed but five cases in adult life. Seitz recorded a case in a woman aged seventy-three.

Symptoms.—The period of *incubation*, two to three weeks, is uncommonly long, while the stage of invasion, or prodromal stage, one-half to one day, is uncommonly short. An initial chill is an exception; malaise, pain in the head, back, or joints, anorexia, rarely vertigo, very rarely more pronounced distress on the part of the nervous system, more or less immediately usher in the eruption and affection of the mucosæ and glands. Not infrequently the appearance of the eruption, totally unprefaced by any fever, is the first sign

of disease. The *eruption* appears as *minute rose-red maculæ*, discrete or confluent, "like dark-red ink pen points in white blotting paper," on the forehead and temples, spreading quickly over the rest of the face, neck, and trunk, to reach full efflorescence and begin to fade in twenty-four to thirty-six hours. By the third day, as a rule, all signs of eruption disappear without desquamation. Coincident with the eruption is a rise of temperature to 99° to 101° F., very exceptionally to 102° to 103°.

Hyperæmia of the conjunctiva with *photophobia* and *epiphora*, of the nasal mucous membrane with a sense of dryness and irritation, with *sneezing* or with increased *discharge*, more especially hyperæmia or visible *enanthem of the fauces and pharynx*, may precede the eruption during the stage of invasion, when it occurs, to co-exist with the eruption, and remain after it as late as the fourth day of the disease.

Affection of the *glands* constitutes a much more distinctive feature of rubella. The cervical, submaxillary, and occipital glands, more rarely also the glands of the axilla, elbow, and groin, become swollen and tender, limiting the movements of the head at times in the swelling and stiffness of the neck. These *adenopathies*, which exist in fifty to seventy-five per cent of cases, disappear entirely in two or three days. Abnormal cases show only an eruption or only affection of the glands.

As a rule, the physician is summoned to distinguish the eruption, which, as stated, appears earlier, often without any previous disorder; is lighter in color—a rose, not a raspberry red; more frequently discrete, or, when confluent, more diffuse, not aggregated into patches; disappears completely, without, or with but slight, desquamation, in one to three days. These features, in connection with the more pronounced implication of the throat and the glandular affections, sufficiently distinguish the disease.

Rubella is distinguished from *measles*, the only affection with which it is likely to be confounded, by the history or absence of a previous attack of measles; by the existence of other cases; by its feebler contagiousness, longer incubation, shorter invasion, hence earlier appearance of the eruption, absent or but light or limited affection of the mucosæ, more frequent and extensive adenopathies, more trivial fever, and shorter duration.

Rubella is distinguished from *scarlatina* by the history of the individual, as stated above; by the longer incubation, two to three weeks in rubella, one day to one week in scarlet fever; by the characteristic intense sore throat of scarlet fever in contrast with the trivial catarrh of rubella; by the violence of the invasion of scarlatina; vomiting, hyperpyrexia, often delirium and convulsions, in scarlet

fever, all absent in rubella; by the more universal affection of glands in rubella, more intense inflammation and tumefaction of the submaxillary glands only in scarlet fever; by the appearance of the eruption first upon the face or universally in rubella, first on the chest and neck with slower spread in scarlet fever; by the disappearance of the eruption in one to four days in rubella, in four to six days in scarlet fever; by the disappearance of symptoms with appearance of the eruption in rubella, by the persistence of symptoms during the eruption of scarlet fever; by the strawberry tongue of scarlet fever, absent in rubella; by the albuminuria and affections of the kidney in scarlet fever, absent in rubella; by the desquamation, membranous in scarlet fever, absent or furfuraceous in rubella.

The roseola, adenopathies, and sore throat of *syphilis* could not, on account of their persistence, be long mistaken for rubella, even in the absence of all history of a primary infection.

The diffuse erythemata of a *drug eruption*, antipyretics, copaiba, chloral, etc., have a history of their use, are unattended with fever, sore throat, or affections of the glands.

Inasmuch as most people escape rubella, isolation of cases in a separate room or story of the house is, when practicable, advisable.

The mortality is almost *nil*. In this regard the disease has, however, the same history as measles. Bad surroundings may impart great gravity. Hospital and tenement-house practice furnishes a mortality of three to ten per cent, due almost wholly to complications, chief among which are capillary bronchitis and broncho-pneumonia.

Treatment, which is for the most part superfluous, does not differ, when necessary, from that of measles.

SCARLATINA.

Scarlatina; scarlet fever; German, *Scharlach;* Italian, *scarlatto*, red.—A treacherous, acute, contagious infection, characterized by a more or less typical fever and inflammation of the throat, a diffuse scarlet exanthem followed by membranous exfoliation of the skin, occasionally by otitis, exceptionally by arthritis, and not infrequently by nephritis.

History.—The first use of the term febris scarlatina is found in a comment by Lancelotti, of Italy (1527), but it was not distinctly applied to the affection as we know it until by Sydenham (1661), who first separated it from measles, with which it had hitherto been confounded. Sydenham saw only mild cases. He considered the disease "only an ailment; we can hardly call it more," but was able to recognize it without the help of throat symptoms, which he does not mention in his brief description. It was, however, a full cen-

tury after Sydenham before the ability to separate scarlatina became common property, and no sooner was it firmly set upon its tripod of symptoms, to wit, fever, exanthem, angina—that is, no sooner were the throat symptoms established as an integral factor of the disease—than it became confounded with diphtheria as much as it had ever been with measles. Irregular cases of either are not yet easily disentangled.

Etiology.—Whence it was originally imported or when it first appeared in Europe is unknown, but it was first recognized in England in 1661, Scotland in 1716, Germany and Italy in 1717, Denmark in 1740; North America, Kingston and Boston in 1735, New York and Philadelphia in 1746, Ohio and Kentucky in 1791, Toronto in 1843, New Orleans in 1847, California in 1851.

The disease is rare in Asia and Africa, and is said to be (Wernich, 1871) entirely unknown in Japan. Scarlatina is therefore much less widely disseminated than measles and small-pox, both of which have repeatedly ravaged Asia and Africa.

A pronounced peculiarity of scarlatina, in distinction from measles and small-pox, is the *variation in the intensity* of epidemics, which are sometimes so mild, as in the time of Sydenham, that the affection *vix nomen morbi merebatur* (scarcely deserved the name of a disease), and again virulent and malignant, more especially in villages and small towns, with a mortality as great as that of cholera and the plague. "Malum hoc grave," said Sennert almost simultaneously with Sydenham, "periculosum et sæpe lethale est." Bretonneau never saw a single fatal case of scarlet fever in all his practice during twenty-four years—1799–1823—but in 1825 he encountered an epidemic so virulent as to cause him to entirely change his opinion regarding the benignity of the disease. Lewis Smith relates that a distinguished physician of New York treated more than fifty cases of scarlet fever in one of the hospitals, without a single death. A few months later his own son died of the disease. That this virulence is not due to the accumulation of susceptible material in long intervals of absence is proven by the experience of Köstlin, of Stuttgart, who observed an epidemic in 1846 so mild as to be without a single death, following an interval free of scarlatina for a period of sixteen years.

Soil, season, climate offer no explanation of this peculiarity; we remain as yet, in the language of Drake, "entirely ignorant of the causes or conditions which determine these remarkable diversities of phenomena and danger."

Thus it may be said that since small-pox has been shorn of its terrors, scarlatina takes rank, next to diphtheria, as the most dreaded of all the infections which now prevail. It is estimated to cause one-

twenty-fifth to one-twentieth of the whole mortality in England and America.

Susceptibility to scarlatina is much less than to measles, one member of a large family being often alone attacked. Hence the majority of individuals escape it throughout life. Individual families seem predisposed to or exempt from the disease. Ziemssen says he saw cases which annihilated posterity, and practitioners everywhere have become demoralized by the loss of one member after another of a family to literally extinguish it. Geil attributes susceptibility to the condition of the throat. The disease, to take hold, must have a denuded surface. While epidemics of scarlatina are much less frequent than measles, decades often intervening, individual cases are much more common. It is said that children have been born at various stages of the disease, but it must be remembered that hyperæmia and desquamation occur frequently in the new-born in health. Sucklings certainly enjoy comparative immunity. The age of predilection ranges from two to seven. Sixty per cent of cases occur before the age of five, ninety per cent under ten. Attacks later in life are rare and are usually mild. Here too, however, are observed the same differences in epidemics. Thus, in Ziemssen's report, the mortality among adults in 1865–1875 was 11.5 per cent, and in 1876–1887 it was but 1.3 per cent.

One attack confers immunity, as a rule, for life. With an observation of two thousand cases Willan never saw a second attack. A second attack is possible, but rare, and occurs more especially in cases of exposure in more advanced life in taking care of a younger member of a family affected with the disease. These second attacks are, as a rule, so abortive or rudimentary as to be easily overlooked, and are recognized at times, as are first attacks in the mildest cases, only by sequelæ. Hence the suspicion may be entertained that some of the insusceptibility of certain individuals may be immunities conferred by attack so mild as to have been considered ephemeral affections. Most so-called second attacks are erythemata, rubellæ, septic rashes, etc.

Pregnancy certainly protects against it, but puerperium and open wounds of any kind invite it.

Regarding puerperal scarlatina, caution must be entered against confounding it with septicæmia, which often shows fever and eruptions simulating scarlatina. There is no doubt, however, that the puerperal state confers additional susceptibility to scarlatina. In these cases the eruption occurs more quickly, almost suddenly. The throat symptoms are much milder or are absent altogether, while local lesions about the vulva and uterus predominate.

In proof of the increased susceptibility of the puerperal state,

Boxall declared of his cases that ten had had scarlatina before, and one had had it twice.

With reference to surgical scarlatina, so-called, the same precaution must be entertained to prevent confusion with erysipelatous, erythematous, or other eruptions of septicæmia.

Etiology.—The disease is conveyed by contact, direct or indirect, as by clothing eminently, by washing, bedding, furniture, letters, books (as from a library or school), toys, etc. A not infrequent source of infection is milk, sometimes from an infected dairy. Perhaps the most instructive example of this source of contagium was furnished by Miller, who reported twenty-four cases of infection in this way.

The disease may be conveyed also by third persons, who may carry the poison in their hands, hair, or clothing, but may themselves remain exempt. Convalescents from the disease carry it to school, church, theatre, train, etc., and disseminate it throughout a community.

The cause of the disease is said to be disseminated from the skin or the secretions, and given off during incubation and desquamation, as well as during the stage of eruption. There is as yet no direct proof that the poison of scarlatina lies in the skin. It is singularly tenacious, adhering to clothing after months of disuse, and to rooms after months of vacation and seemingly thorough disinfection and ventilation. The poison of scarlatina literally lurks in long-discarded clothes. Cold does not affect it. It is destroyed, however, by heat, especially by steam, and quickly by steam in motion—so-called "live steam." Henry, after subjecting the flannel garments of scarlatinous patients to a dry heat of 212° F., had them worn by unaffected children from six to thirteen years of age, no infection following.

Bacteriology.—The cause of scarlatina, presumptively a micro-organism, has not yet been definitely determined. Klebs (1880) pictured and described a structure found in the blood as the *monas scarlatinosum.* Eklund, Stockholm (1881), Power, Cameron and Klein (1885–86), Jamison and Eddington (1887), Marr (1891), all ascribed to various micro-organisms pathogenic properties, but all these various micro-organisms are now believed to be varieties of the ordinary pyogenic bacteria. It cannot as yet be maintained of any of them that they are found uniformly or only in scarlatina, nor that the disease produced by them is really scarlatina. It is not yet established that any of the lower animals are susceptible to the disease. It would be more natural to look for the poison in the throat and in the blood in the earliest stage of the disease, rather than in the secretions from the kidneys or the substance or exfoliations of the

skin. The kidney affection is doubtless the result of a chemical poison in its escape from the body, and the exanthem must also be regarded as toxic, like that produced by certain drugs. Luff has succeeded in eliminating a hitherto unknown alkaloid from the urine of scarlatina, and Leyden declares it to be useless to look for the poison of scarlatina in the skin.

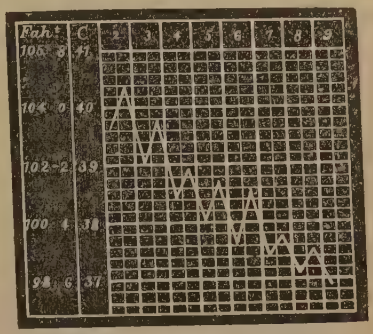


Fig. 130.—Mild scarlatina

Regarding the relation of diphtheria, it is admitted that one may follow the other, and that they may even coincide, but only as exceptions. The rule is that the diseases prevail in communities and exist in individuals independently of each other. Tangl's culture studies never

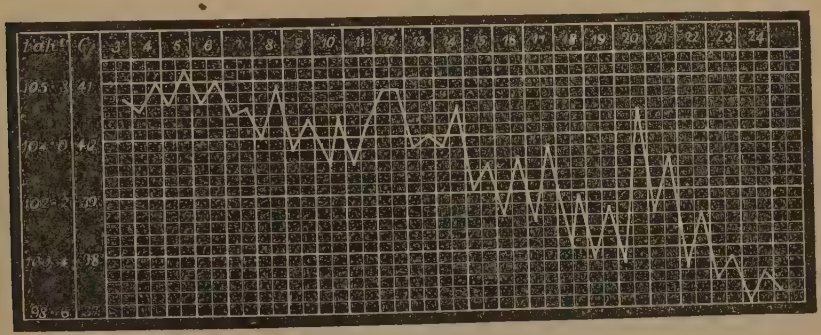


Fig. 131.—Protracted scarlatina.

once developed from the angina of scarlatina a specimen of the bacillus of diphtheria.

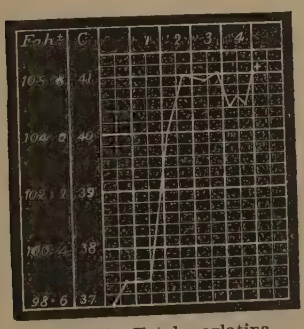


Fig. 232.—Fatal scarlatina.

Symptoms.—The period of *incubation* is short, ranging from one to seven days. Ziemssen declares that the few unimpeachable observations that we possess put it at seven days. English writers make it generally less, and declare that from the second day after exposure liability of attack grows progressively less.

The *invasion* is usually sudden and violent; grave, dangerous, and sometimes fatal illness developing within a few hours. An initial *chill* or series of *shiverings* is attended with

a quick and high rise of temperature. It is more frequently the case that the disease is ushered in without any chill at all. A child presents evidence of attack in a *shock*, manifest by extreme pallor and prostration. A highly susceptible, sensitive child may be seized with a *convulsion*. Usually the scene opens with *vomiting*. Early vomiting belongs to all the grave, acute infections. It occurs with especial frequency in scarlatina because of the gravity of the disease. After the vomiting it is noticed that the patient has *fever*. Inspection thus early reveals *angina*, or the child complains at once of *sore throat*. Vomiting, sore throat, and fever at the start should excite the suspicion of scarlatina, or, in the presence of an epidemic or proximity of another case, establish the existence of the disease. The temperature distinguishes itself by the rapidity of its ascent. The ascent of the temperature in scarlet fever is more rapid than in almost any other disease, reaching often within twenty-four to forty-eight hours 104° to 107°. *Calor mordax* was the term applied by the older prethermometric writers to express the biting heat of the skin. The temperature reaches its height with the efflorescence of the eruption, and terminates by lysis, barring complications, in one to two weeks.

In correspondence with the height of this fever, especially in young children, nervous signs, as stated, show themselves—*delirium* and *convulsions*. The delirium may deepen rapidly into coma. There is in every marked case profound prostration. It is seen on the most superficial inspection that the child is seriously ill. This stage of invasion lasts from one to two days. Comment has been made upon the irregularity or variety in severity of epidemics of scarlatina. The same variety is noticed of individual cases in the same epidemic. In the same family, side by side with a malignant case, occurs an attack so mild that it may be scarcely recognized. Lightly affected brothers and sisters may be playing about the house where one member lies fatally ill or has just fallen a victim to the disease. So there may be every grade of intensity in the onset, but, as a rule, the disease is announced by a sudden attack of fever attended by vomiting, which assumes more and more importance when it may not be accounted for by a sufficient provocation, as by indigestion, or by other infection, croupous pneumonia, cerebro-spinal meningitis, small-pox, etc.

In the absence of these symptoms the diagnosis must be held in abeyance until the appearance of the eruption. The *eruption* shows itself in twelve to twenty-four hours after the initial symptom, chill or vomiting or shock, on the face, over the forehead, cheeks, the chin, and often at the same time, as a rule in fact, at the clavicles. Here, at least, it is first seen. When search is made it may usually be discovered soonest on the *neck, breast, and back*. It usually

spares or skips the region of the mouth, which is left blanched by contracted capillaries, in striking contrast with the scarlet flush of the rest of the face. The *white line about the mouth*, the apparent bleaching of the chin, make the diagnosis easy as between this disease and measles or small-pox. Seen at some distance the eruption appears uniform, but close inspection shows it punctate, with confluent halo; yet, though confluent, there are lines or spaces here and there of unaffected surface. This marbled appearance of the skin is very characteristic, and is due to the intense irritability of the vasomotors, which show paralytic dilatations and spasmodic contractions in the same sets of capillaries. The deeply colored skin is bleached out by pressure in lines or surfaces, so that figures or letters may be inscribed upon the surface with a vividness equalled in no other disease.

The *color is scarlet*, that bright red which is designated by this hue, in striking contrast to the duskier red of measles. The Germans speak of the crushed-raspberry color of scarlatina, as distinct from the mulberry hue of measles. The shade becomes darker, however, in bad cases, or especially under defective hygiene, when it may be substituted by hæmorrhagic eruptions. In a pronounced case the affected skin is more or less œdematous. The eruption lasts from four to six days, extending meantime over the body, but with less uniformity over the extremities, where it may show itself only in blotches or patches. It begins to fade in the order of its appearance, first from the face, neck, and chest, later over the body, and disappears with a desquamation or *exfoliation of the skin*, which constitutes one of the peculiar features of the disease. From regions covered by a thick epidermis, the hands and feet, more or less perfect casts, epidermic gloves and stockings, may be detached. More or less perfect specimens of this kind are to be found in the museums. The desquamation begins usually on the sixth day. It may be, in a mild case, furfuraceous. It may, indeed, be absent altogether, but it is usually, as stated, membranous or lamellar, the skin peeling off in strips and flakes. The process may be repeated several times during the course of the disease, to form at times an interesting diversion or an annoying occupation of convalescence. It is impossible to overrate the value of this process of desquamation. It confirms the diagnosis in a doubtful case. It establishes the pre-existence of the disease. It reveals the nature of a meningitis, rheumatism, an ear disease, a nephritis, which have suddenly or insidiously developed.

The *sore throat* is one of the cardinal symptoms of the disease. It precedes the eruption, as has been said, and constitutes at times an overshadowing symptom. Suspicion is excited of the existence of scarlatina by the fact that the child complains of the throat, and it is

seen that there is some hesitation or difficulty with deglutition. The act of swallowing is marked by an expression of pain; by the application of the hands to the neck; sometimes, as a rule later in the course of the disease, by regurgitation of fluids through the nose. In many cases an inspection of the throat discloses at a glance the character of the disease. As a rule, the sore throat of scarlatina differs in no way, at first, from that of a simple catarrh. There is redness, dryness, and swelling. The mucosa is puffed or glazed, especially about the soft palate and uvula. The *glands* of the neck become *swollen* and tender. Diphtheritic patches, often gangrenous sores, may appear later, while an extensive *interglandular cellulitis* may swell the neck to such degree as to obliterate its natural outlines. It is therefore not at all strange that scarlatina is often confounded with diphtheria. It is to be remarked, however, that no individual symptom shows such variation of intensity as the angina. Throat symptoms may be so mild as to be detected only on close inspection—*scarlatina simplex* or sine angina; or so severe, as said, as to overshadow all other signs—*scarlatina anginosa*, of the older writers. It is now no longer an unsettled question whether the diphtheritic exudations which occur in grave cases belong intrinsically to scarlatina or to a complicating diphtheria. The view now prevails that the affection is primary. It is produced by the micro-organisms of pus. It belongs to scarlatina, and it may, in the vast majority of cases, by culture be differentiated from diphtheria.

Among the disturbances of the digestive organs common to all the infections, the *condition of the tongue* is peculiar in scarlatina. The tongue is coated white and studded with red spots, the protruding swollen papillæ, to constitute what is known as the *strawberry* or mulberry tongue. While this condition is not absolutely peculiar to scarlatina, it occurs in it more frequently than any other infection, and from its obtrusiveness is regarded as a sign of much value. It is unfortunately not always present, but when present it should excite at once suspicion of the existence of this disease.

Scarlet fever shows predilection for three organs besides the skin and throat—namely, the *ear*, the *joints*, and the *kidneys*. The way is open to invasion of the ear from the throat through the Eustachian tube. So scarlatina is the most fertile source of earache, otitis media, and otorrhœa. The membrane of the drum is seen to be intensely reddened on inspection, or it may be paler and pushed outward by fluid pent up within the drum cavity.

Suppurative processes may intervene, to extend to or directly involve the fold of dura mater which in the young pushes into the cavity of the drum. Scarlatina is thus the most frequent cause of an immediate or ultimate lepto-meningitis.

Affection of the joints is much more uncommon, but there occurs in certain cases or certain epidemics a peculiar scarlatinal rheumatism affecting chiefly the larger joints—ankle, wrist, elbow, and knee. The affection runs usually a mild and short course, but may, unlike true rheumatism, result in suppuration or leave permanent deformity. The joint affection is to be referred in these cases to a mixed septic or secondary pyogenic infection.

Of all the signs, complications, or sequelæ connected with scarlatina, no one assumes such prominence and importance as the *affection of the kidneys*. Scarlatina is said to be the mother of acute nephritis. Aside from the transitory albuminuria which may attend any high fever, disease of the kidneys is comparatively frequent. Epidemics are distinguished from each other in this regard with entire or comparative absence and frequency of this complication. The severity of the individual case or of the epidemic does not necessarily indicate the probability of nephritis. It cannot be said that early exposure, as to cold, predisposes to it. It may not be ascribed to affection of the skin ; small-pox, with its destructive lesions, does not show it. Every case marked by high temperature shows, as stated, some albuminuria, but the albuminuria which excites apprehension is that which appears, not at the height, but in the later course of the disease, at the end of the third week after the disease proper, during convalescence. Strictly speaking, the process is, therefore, a post-scarlatinal nephritis. It sets in on the tenth to the thirty-first day—on the average in twenty days after the first show of the rash. It is an acute parenchymatous process, from which the patient recovers or succumbs quickly, very rarely developing into chronic Bright's disease. It is announced often by *nervous symptoms*—headache, neuralgia, vertigo, insomnia, restlessness, blindness, convulsion, or coma. *Puffiness of the eyes*, any local *œdema or dropsy*, should excite suspicion of its presence.

Scarlatinal nephritis may be divided into two periods, in the first of which there is a diminution in the quantity of urine, albuminuria, and some of the general symptoms mentioned. The second period is distinguished by hæmaturia with the discharge of formed elements, granular and epithelial casts, also with an increase in the quantity of urine and diminution of the general signs. So that should the urine become more abundant, contain more blood, and exhibit formed elements, though grave symptoms may still show themselves for a time, the worst is over, and, as Sörensen puts it, "the kidneys are beginning to free themselves of the disease." Perhaps the most grave single symptom of nephritis is *anuria*, but even long-continued anuria is not incompatible with recovery. While it may be said that the gravity of the case corresponds in a general way with the degree

of oliguria or the duration of anuria, there need never be despair as to the possibility of recovery, as Whitelaw reported a case of recovery after a total absence of urine for twenty-five days. As a rule, it may be said that the blood and albumin disappear in mild cases, and the patient recovers from the nephritis entirely in two to three weeks.

Forms.—Besides the typical form described, scarlatina shows itself in variation as follows: 1. Abortive, in which the eruption disappears after a short duration, without, or with very mild, throat symptoms, but usually with lamellar desquamation, and sometimes with subsequent nephritis. 2. Fulminant, in which the patient is killed by the poison of the disease before the period of eruption. 3. Anginose, in which throat symptoms predominate. 4. Malignant, with the status typhosus, in which all symptoms are intense and hæmorrhage may occur free from the various mucosæ or into the skin, or with rapid collapse after the signs of a cholera morbus. In some very exceptional instances of undoubted scarlatina the eruption is entirely wanting, throat symptoms only presenting. In these cases careful inspection will usually disclose some eruption on covered parts, especially on the posterior aspect of the body. It may be seen at times on or over any part of the body immediately after death from fulminant forms.

True diphtheria may coincide with or follow scarlatina; much more frequently the membrane which forms in the throat is *sui generis*. The membranous angina or pseudo-diphtheria of scarlatina is much less amenable to treatment than true diphtheria.

The *diagnosis* rests upon: 1. The absence of previous attack. 2. The existence of other cases. 3. The short period of incubation—one to seven days as a rule. 4. The violence of the invasion, especially the occurrence of unprovoked vomiting (eighty per cent of cases), and the nervous symptoms. 5. The early appearance (second day) of the eruption, which shows itself first usually about the clavicles, is scarlet-colored, diffuse, but punctate upon close inspection; in its disposition about the face commonly sparing the mouth, showing in vivid contrast the blanched lips and the blazing cheeks. 6. The strawberry tongue. 7. The early appearance of throat symptoms with glandular enlargements in the neck. 8. The lamellar desquamation. 9. The ear complications. 10. Nephritis.

In very mild, sporadic, or anomalous cases the diagnosis may be determined only by desquamation, complications, or sequelæ.

Scarlatina is differentiated from *measles* by knowledge of previous attacks of either, existence of other cases of either, especially in the same family, neighborhood, or school; by the longer incubation of measles, when the period of exposure may be (exceptionally)

known; by the coryza which precedes the eruption of measles, and the angina that of scarlatina; by the shorter or more intense invasion of scarlatina with vomiting, and sharp nervous symptoms not so common in measles; by the time of appearance of the eruption (twenty-four to forty-eight hours after initial chill or vomiting in scarlatina, four days in measles); by the color, character, disposition, and duration of the eruption (dark red, aggregated in patches, and disappearing in two to four days in measles; scarlet-colored, punctate, diffuse over the chest and face, sparing the mouth, disappearing in eight days plus in scarlatina); by the complications or sequelæ (bronchitis, catarrhal pneumonia, in measles; joint and ear affections, nephritis, in scarlatina); by the desquamation (usually branny in measles, membranous in scarlatina).

Scarlatina is differentiated from *rubella* (rötheln) by the longer incubation or shorter or absent stage of invasion; by the darker colored and shorter duration of the eruption of rubella; by the associate catarrh of the nose and eyes in rubella, absent in scarlatina; by the much more severe faucial inflammation and gland implication in scarlatina; by the much milder character and shorter duration of rubella.

Septicæmia and pyæmia show, with the history of a cause, successive chills, irregular temperatures, efflorescences, quite different in appearance and order of distribution from the eruption of scarlatina; more marked enlargement of the liver and spleen; more common general affections, metastatic processes, longer duration. Erythema, a diffuse, rather dark redness, without points or desquamation, though sometimes with a light furfuraceous desquamation, with absent or but very slight fever up to 100° F., has neither the throat symptoms nor complications of scarlatina, and disappears in a few days. Drug eruptions—copaiba, cubebs, antipyretics—have a history of administration, no fever, no complications.

Scarlatina differs from *diphtheria* in its cause. It may be declared that the cause of diphtheria has been now definitely determined. While the same cause is not to be found in unmistakable cases of scarlatina, it must be held in mind that the diseases may, as stated, coincide, and that either may be a sequel to the other. These things, however, are exceptional; the rule is that the diseases exist alone, and that, as stated, the exudation of scarlatina is not that of diphtheria, but is *sui generis*.

Clinically the affections differ as follows: The false membrane appears at once in diphtheria, later in the course, three to five days, of scarlatina. It shows itself in nearly all cases of diphtheria, but in only severe cases of scarlatina—namely, such as are marked by high fever, delirium, etc., at the start. It shows a preference, after the

pharynx, for the larynx in diphtheria, and for the upper respiratory passages in scarlatina. In connection with it suppuration of the cervical glands and affections of the ear are frequent in scarlatina, rare in diphtheria. The interglandular connective tissue is indurated in scarlatina, and only œdematous in diphtheria. Paralysis, which is frequent in or after diphtheria, is almost unknown in scarlatina. On the other hand, nephritis, a frequent sequel of scarlatina, is very rare after diphtheria. Lastly, as stated, treatment has much less effect on the membrane of scarlatina. For all these reasons it is proposed by good clinicians to abandon the use of the term "diphtheritic" in scarlet fever, and to designate such cases as "membranous scarlatinal anginas."

Besides the affections of the organs mentioned, grave *complication* is not infrequently presented by the intense inflammation about the neck. The glands, the lymph vessels, the interglandular tissues are swollen and amalgamated into a mass of board-like induration, which fixes the head to the body, compresses the great vessels, and results not infrequently in extensive suppurations. *Phlegmonous processes*, gangrenous destructions, occur frequently in connection with diphtheritic or pseudo-diphtheritic deposits in the throat. The pressure may compress the trachea or suffocate by *œdema of the glottis*. Pus may burrow down into the chest, to erode in its course large vessels and to lead to fatal hæmorrhage or destroy important nerves or other structure. The inflammation of the throat may extend to involve the larynx and bronchial tubes. Pneumonia, both *bronchial and croupous*, occurs not infrequently in grave cases. Hæmorrhage of the lungs, gangrene, more especially œdema, hypostases, take life directly or indirectly by overstrain of the heart.

The most frequent and fatal so-called end or terminal complications are the affections of the *serous membranes*. Meningitis heads the list, in that it is not only the most severe but most early membrane involved. It occurs at times almost with the onset of the disease, so that the separation of this affection from toxic effects of the blood poison upon the brain itself may be difficult. In *meningitis* the headache becomes more intense, or recurs if it shall have subsided. The special senses suffer extreme hyperæsthesia. There is usually evidence of affection of the membranes of the spine, opisthotonos, vomiting, convulsions. The pleura is next most frequently affected. Scarlatinal *pleuritis* distinguishes itself, strange to say, by its unilateral character, and differs from pleuritis from other causes in the fact that it so easily becomes purulent. *Pericarditis* is usually so much more rare as to be generally overlooked, while *endocarditis* is readily recognized by its valve lesions, hypertrophies, and embolic products.

All these various complications are now known to be due to the micro-organisms of pus, which, strictly speaking, have nothing really to do with the cause of scarlatina. The cause of scarlatina opens the way for their invasion, and these micro-organisms, or the evidence of their invasion, have been traced directly from the throat as the avenue of entrance.

The *prognosis* of scarlatina varies greatly, perhaps as in no other disease. On account, however, of the severity of certain epidemics, and of the suddenness with which the disease may assume gravity in any individual case by reason of its own poison or by reason of complications, the prognosis is always grave. Reimer, who studied the subject from this standpoint most thoroughly, says that the prognosis of a simple complicated case which has no mortality advances through the complicated cases of medium gravity with a mortality of 25 per cent up to the severest cases whose mortality reaches 83.75 per cent.

In estimating the prognosis it may be said that the pulse, as a rule, corresponds to the temperature. Arhythmia is usually a forerunner of complications. Grave nervous symptoms are always ominous, as are also extensive suppurative processes. It is not good to see the eruption "sink in." The complications on the part of the kidneys, however severe the signs, though grave, are never necessarily fatal. From the gravest accidents recovery is still possible.

Pneumonia, more often of such insidious onset as to have escaped detection at first, pleurisy with its wonted suppurative course, and peritonitis, intensely aggravate the prognosis. Peri- and endocarditis are almost necessarily fatal. An undue protraction of the disease by reason of reabsorption of products to constitute a relapse, or by reason of complications, makes the prognosis grave in correspondence with the intensity of the signs, duration of the disease, or character of the complication. Some of these cases succumb finally to atelectasis, heart failure, decubitus, marasmus.

Prophylaxis.—Isolation is the only prophylaxis; and inasmuch as the area of infection is so closely circumscribed, isolation is much more effective in scarlatina than in measles or small-pox. But as the disease may undoubtedly be carried by third persons, the attendants upon the sick should not come in contact with unaffected members of the family. The best protection is offered by removal from the house of all children liable to—that is, unprotected by previous attack of—the disease. Unaffected children remaining at home may not attend school or other assembly for several weeks after perfect recovery of a member of the family. It is believed, whether it may be proven or not, that contagium emanates from the body so long as desquamation continues, and the child should not be allowed to associate

with its fellows until the last scale of skin has been removed. Desquamation continues longest on the soles of the feet, and inspection of these parts gives the best answer as to the time when all desquamation shall have ceased. Such desquamation has been observed as late as forty days after the disappearance of the eruption, though it usually ceases entirely in less than half that time.

Prophylaxis implies also the destruction or thorough disinfection of all articles which have come in contact, direct or indirect, with the patient. The room should be disinfected, ceilings whitened, walls rubbed down with bread, floors scrubbed with corrosive sublimate solutions, carpets or rugs beaten and suspended in the open air for a long time, bedding and clothing boiled if not buried or burned, or, if preserved, subjected to live steam. It is a sad comment upon our sanitation that public disinfecting stations are not yet established in all our cities and towns. Prophylaxis involves attention to detail. The disease has been conveyed by letters sent out from a sick-room, by cushions of chairs, curtains, piano covers, etc. Special attention must be paid to the discharges, to sponges, cloths, towels used in ablutions. The fact is that sponges, handkerchiefs, etc., are best substituted by rags, which may be immediately destroyed by fire. It must not be forgotten that the hair of the head retains and conveys contagium. Thorough ablution with soap and water or with the carbolized soaps will disinfect the hair. The hair of the boy patient should be cut short. It must be remembered even that the shoes require disinfection. They may be painted inside and out with carbolic acid and glycerin, equal parts. Ventilation of the sick-room throughout the whole period of the disease is not only a necessity of treatment but also of disinfection. The frequent bathing of the body, with the subsequent application of some unctuous material—cocoa butter, lanoline, vaseline, etc.—not only gives great comfort to the patient, but confines the poison to a narrower field. After the recovery of a patient, more especially after a death, outside windows should be thrown open and the room ventilated for a week. Here, too, attention must be paid to detail. Closet doors must be opened and the inside of closets with their contents disinfected and ventilated as before. The fact is, the city government should take charge of all such apartments. They should be disinfected and ventilated under the inspection of health authorities. The inside doors to halls and other rooms should be closed by the seal of authority, and the same precautions taken as in the prevention of entrance or interference in cases of crime. Scarlet fever is for the most part spread by ignorance, by carelessness, by blunders which are worse than crimes. Reference is made here to the premature return of children to schools or the constant attendance at school of unaffected members of a family,

to contact which is effected in street cars, railroad trains, steamers, etc. Parents, nurses, even physicians, are all too careless in this regard.

In the way of a drug there is no preventive of scarlet fever. The claim that a drug may protect against the disease, because when administered it produces a symptom which resembles that of the disease, is, in the light of our present knowledge regarding the infections, worse than mediæval gibberish—worse because it may beget a sense of false security in exposure. This claim has been made for belladonna because it flushes the face. It has no more foundation in fact than protection by a blush, which has the same effect. Belladonna, by making a child sick, rather predisposes to, than protects against, scarlatina. The hope that has been cherished regarding protection by vaccination has proven equally vain. Attempts have been made to inoculate certain disease products of animals—horses, dogs, rabbits—with a view of producing a milder or more modified form of scarlatina. Claim has been set up in this direction, as by Strickler, who introduced the nasal mucus of horses supposed to have been affected with the disease into the bodies of twelve children, in all of whom it produced sores at the point of introduction, with circumjacent inflammation of the skin and lymph glands. It was stated that these children thus inoculated failed to contract the disease after exposure to scarlatina. These experiments were made in imitation of the first experiments of Jenner with reference to small-pox, but the objections to accepting such conclusion are numerous and obvious. In the first place, it is not known that any of the lower animals really suffer scarlatina or any allied disease. Secondly, it has not been established by experiment that the disease which results from the introduction of scarlatinal matter of man into animals is really scarlatina. Third, it could not, therefore, be known that matter taken from animals was the product of this disease. Fourth, susceptibility is so much less in scarlatina that failure to contract the disease after exposure has not the same weight as in small-pox.

Treatment is wholly symptomatic. The sick-room requires constant, thorough ventilation from the outside air. The temperature should be held at 65° to 70°, as registered by a thermometer, not at the door, window, or fire, but at the head of the bed. An open fire in winter is preferable to any other method of heating. The patient should wear a long muslin night dress, without other clothing. The bed covering must be as light as is consistent with comfort.

Milk and meat soups make the best diet. Water, carbonated water, Selters, Apollinaris, lemonade, toast water, barley water, should be given freely to relieve thirst and to keep the kidneys flushed. Drink should be proffered in fever once an hour during the day.

The utmost cleanliness is to be maintained by frequent sponging and bathing of the surface. Daily tepid baths (full length) give the greatest comfort throughout the disease. Fever above 103° is best combated with cold sponges, cold packs, cold baths. Cold baths are most effective, but are seldom practicable as yet. It is not essential that the temperature be brought down to the normal degree. A reduction of a few degrees suffices to give the patient comfort and relieves all danger attendant upon high temperatures. A warm or tepid bath will reduce the temperature one or two degrees, and patients solicit such bathing when a cold bath may excite terror. While it is true that the temperature reaches the highest grades in scarlatina and the patient suffers corresponding discomfort and danger, it is not true that the danger is caused by the fever. The danger, the discomfort, and the fever are produced by a common cause—namely, the poisoning of the blood—and there can be no question of radical therapy until after the discovery of some agent, some antitoxine, which will neutralize the chemical poison circulating in the blood. It is, indeed, a question if some fever be not salutary. We combat the fever in our day more especially with regard to the comfort of the patient. A difference of two degrees makes a great difference in the feelings of the patient. The reduction of high temperatures by cold bathing is attended, as a rule, with the diminution of discomforts and dangers. The bath addresses the cause indirectly through its effects. The real virtue of the cold bath lies in the fortification of the heart. Frequent bathing is the best therapy in the treatment of scarlatina, as of any other infection. There may be reasons which render a bath impossible. In these cases resort must be had to frequent ablutions. It may become necessary to substitute a bath by drugs, especially in the presence of other indications. Resort may then be had to the antipyretics. Phenacetin is the least injurious. It may be given to a child in a dose of gr. ijss.–v., to an adult in double this dose, once or twice in the course of a day. It is of especial value in headache or other nervous distress. It is best administered in capsule or in powder taken directly upon the tongue, stirred —that is, suspended—in milk, or, in case of high fever with dry tongue, floated upon the surface of a teaspoon of water. Only in case of failure with phenacetin should resort be had to antipyrin or antifebrin, either of which must be given in half the dose of phenacetin. Burning and itching of the skin are best allayed by application, after tepid baths, of vaseline, cocoa butter, lanoline, goose grease, bacon, or fresh lard. Quiet, peaceful, and more or less restorative sleep is wont to occur after a bath and inunction in this way.

Nervous distress, jactitation, convulsions, insomnia, headache, are best combated by bromide of sodium, gr. v.–x. to a child, gr. xxx.–xl.

to an adult, largely diluted ; or, if more obstinate, by sulphonal or trional, gr. v. to a child, gr. xv. to an adult, dissolved in a cup of hot milk or tea, or chloral, gr. v. to a child, gr. xv. to an adult. No other single remedy gives the comfort of chloral in small, two or three grain, repeated dose. Broken doses of Dover's powder, gr. i. to a child, gr. iij.–vi. to an adult, may substitute it in suitable case. Ice bags should be applied to the head for meningeal symptoms. The vomiting which occurs in the inception of the disease is often sufficiently relieved by carbonated drinks, the best of which is the German Selters water with milk equal parts, or by lime water and milk one to three, by small doses of bismuth gr. v.–x., by the bicarbonate of soda in equal dose, by sips of water excessively hot. The most powerful drug we possess is chloral. The most refractory vomiting, of whatever cause, will yield to the administration of a few two- to five-grain doses of chloral diluted in a dessert- to a tablespoonful of peppermint water. Should the remedy be rejected before it can be absorbed, it may be introduced into the bowel in double dose. It must be a remarkable case to resist chloral in one or other of these modes of use, or to justify resort at last to a subcutaneous injection of morphia.

Throat symptoms call for inhalations of steam, best from the steam vaporizer, simple or medicated with bicarbonate of soda, saturated solution, or boric acid ʒ ij.– ℥ iv., or carbolic acid ʒ i.– ℥ iv., or thymol gr. v.– ℥ i. alcohol, water ℥ iii.; or gargles of hot water, of carbolic acid gtt. xv.–xxx.– ℥ iv., perchloride of iron ʒ i.– ℥ iv.; or direct applications of carbolic acid with glycerin equal parts, bichloride solutions from 1 : 1000 to 1 : 100, or intraparenchymatous injections (tonsillar) of a few drops of the same solution by means of a hypodermatic syringe with a fine, long aspirator needle. Nothing keeps the throat so clean inside, whatever be its disinfecting properties, as sprays of the peroxide of hydrogen as procured from the shops. Cloths wrung out of boiling water, applied about the throat and covered in by thick dry cloths, relieve the pains of extreme distention.

Affections of the ear are best treated by a douche of hot water and a Politzer inflation with air. Tension in the membrane of the tympanum may require puncture ; and suppuration in the mastoid cells, trephining. Earache is best relieved by instillation of hot water, or solutions of atropia gr. i.– ℥ i. Otorrhœa is best treated by washing the external canal with a solution of boric acid after thorough cleansing with a cotton-wrapped sound, or direct application to accessible granulations of chromic acid, London paste, or the galvanic cautery. Nephritis calls imperatively for hot baths, under which all the symptoms of this complication, including vomiting, are wont to

speedily subside. The bath must be hot (100° to 110°), the patient rolled in blankets after it and be allowed to sweat for an hour.

Rheumatism calls for the salicylates in saturating dose. Alcohol, digitalis, nitroglycerin, may become necessities in the later course of all grave cases, and may be urged in over-dosage together with other analeptics—camphor, ether, musk—in the way of a "forlorn hope" in fulminant forms.

SMALL-POX.

Small-pox, or pocks (*pock*, a bag or sac); variola, diminutive of *varus*, a pimple (a term applied in ancient times to many eruptions, first limited to small-pox in the epidemics of France and Italy, 570 A.D. [Hirsch]); German, *Pocken*, *Blätter* (blister).—A highly contagious, extremely dangerous disease, characterized by violent onset with severe chill, excruciating pain in the back and head, by an eruption of papules, subsequently converted into vesicles and pustules, which leave disfiguring pits or scars, and by a fever which remits at the period of papular efflorescence, to increase in the stage of suppuration.

History.—Small-pox has existed from time immemorial in India, where temples were built and a goddess worshipped, and where, more to the purpose, the Brahmins practised inoculation in protection against it. Accounts of it in Africa date also from the most remote antiquity, and the great susceptibility of the negro race lends color to the view that the disease may have originated in these lands. It was imported into China probably about 200 A.D. Rhazes wrote his famous work concerning it in 900 A.D.

Small-pox entered England in 1241 and Iceland in 1306, but did not reach Germany and Sweden until toward the close of the fifteenth century. It was imported to America first in the West Indies in 1507, exterminating whole races of natives; next by Spanish troops into Mexico in 1520, where it carried off three and one-half millions of people. In the United States it reached Boston from Europe in 1649, and, though decimating the Indians in every direction, made but slow progress and limited ravage among the white races, because of the introduction of vaccination in 1799, the period of commencing Western migration. Thus it did not reach Kansas until 1837, and California until 1850. Epidemics in South America, first in 1554, corresponded with the introduction of slaves from Africa. Certain islands of Polynesia remain as yet exempt.

Small-pox has now only historic interest. It is on the road to extinction, and may occur in epidemic proportion only in uncivilized lands. As now seen it occurs in the modified form known as

varioloid. Since the general introduction of vaccination, small-pox has lost all its terrors for those who recognize its absolute protection. In many parts of Europe small-pox patients are no longer isolated in pest houses, but are received into the general wards of hospitals, other inmates being protected by, if necessary, fresh vaccination. It is computed of the century preceding vaccination that fifty millions of people died in Europe of small-pox. Macaulay called it the most terrible of all the ministers of death.

Etiology.—Susceptibility to small-pox is almost, though not quite, universal. The extent of immunity it is difficult to establish in our day because of the protection of vaccination.

Age.—Though it spares no age, small-pox is essentially a disease of childhood, "interrupted and postponed by vaccination." Of the new-born, one-third die before their first, one-half before their fifth year of life (Werner). Old synonyms of the disease, Kinderpocken, Barnkoppen, attest this fact.

Exemption of maturity and age is due, in some degree at least, to immunity secured by former attack. Accurate statistics disclose the fact that the disease occurs at all periods of life, even up to the advanced age of sixty and seventy.

Sucklings enjoy some immunity. Liability grows intense at the end of the first year and continues up to forty, when it becomes less marked. Pregnancy and puerperium rather invite than repel the disease. Small-pox may certainly attack the fœtus in utero after the fourth month, and children have been born in every stage of the disease.

The disease is severe with the *colored race.* This fact has been noticed not only in their own country, but in all lands to which they have been carried. The more frequent disfiguration of the colored race seen upon the streets is due partly to this cause, but chiefly to neglect of vaccination.

One attack, however light, confers *immunity* for life, with occasional rare exceptions. Louis XV. of France survived an attack at the age of fourteen and died of the disease at sixty-four. One successful *vaccination* likewise protects, but with more frequent exceptions.

Epidemics occur more frequently in the *colder seasons,* partly because of the closer contact of people at this time, chiefly because of the concentration of the contagium in less ventilated rooms.

The contagious principle of small-pox certainly exists in the *skin,* whence it is disseminated about the body of the patient. Inoculation was formerly practised wholly by the matter of the disease in the skin. It was the custom in China in the most ancient times to introduce the crusts of small-pox matter into the nose in the process

of inoculation, and in India to rub the matter on an abraded skin. The fact of infection of the fœtus, which is undeniable, proves that the poison exists in the *blood*. There is, however, no proof of the existence of the poison in any of the various secretions or excretions of the body. Doubt was thrown upon even the infectiousness of the blood, until Zülzer succeeded in communicating the disease to a monkey with the blood of a variolous patient.

The contagious principle has singular tenacity of life. It sticks especially to bedding and clothing, which, if kept secluded at a warm temperature, may remain infectious for months, and even years. It is certain that the pox has been contracted by an individual who has approached a patient no nearer than three feet, and it is well established that the disease may be conveyed by third persons and by things. The contagion is given off from the body at all periods of the disease. Proof of the transmissibility of the disease during incubation was offered by Schäper in the case of an individual who had some particles of skin engrafted upon an ulcer. The particles were taken from an amputated arm of a person during the period of incubation of small-pox. The patient was attacked by variola on the sixth day after the operation.

Bacteriology.—The contagious principle or cause of the disease has not yet been isolated, the micro-organisms discovered being those only of pus. V. Löff claims to have developed in sterilized tubes, from fresh matter, amœbæ or proteids. Pfeiffer claims to have discovered as constantly present in the exanthem of variola a parasite of the species protozoa, which runs its whole course of development in the body of man or other mammal. According to Koch and Schulze our present methods will not suffice to unveil the virus of variola.

Symptoms.—The period of *incubation* varies from ten to fourteen days. *Invasion* is ushered in by a *chill*, which is, as a rule, violent, with *rise of temperature* to 103° to 104° on the first day. Prostration is pronounced from the start. *Anorexia, vomiting, jactitation, insomnia, and severe headache* set in at once. Above all other signs *pain in the loins* assumes prominence. It accompanies the fever from the start, and subsides only with its fall with the appearance of the eruption on the third day.

Inasmuch as the eruption proper does not appear until the third day, especial value attaches to two rashes of earlier occurrence in certain cases or in certain epidemics. One is petechial, the other erythematous. Petechiæ appear on the second day in the form of a fine macular or spotted eruption in the space known as "Simon's triangle," whose base is at the umbilicus, apex at the knees. It may occur elsewhere, especially in the space under the axillæ. The ery-

thematous eruption has its favorite seat on the sides and inner surfaces of the legs from the ankles up, sometimes, in women, about the nipples. This eruption indicates a mild case of the disease, whereas petechiæ have no such prognostic value.

Petechiæ should never be mistaken for the true hæmorrhagic eruption, which may stamp the disease from the start or occur at any later period. Both these eruptions disappear, as a rule, in twelve to twenty-four hours. They may last longer, and they may, especially the petechiæ, leave behind them slight brownish colorations.

The true *eruption* in its very first appearance is purely *macular*. In the course of the very first day, however, the macule is thickened

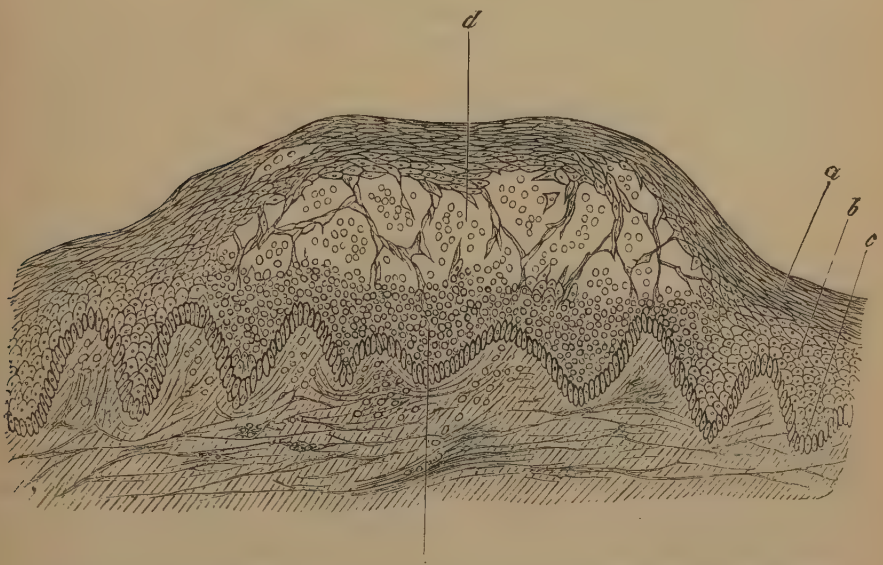


FIG. 133.—Pock of small-pox; *a*, outer layer of epidermis; *b*, middle layer; *c*, rete Malpighi; *d*, reticulated cavity of pock containing pus corpuscles, with the epithelial framework; *e*, purulent infiltration of epidermis (Curschmann).

to become a *papule*. It shows itself first on the *face and scalp*, where it is unfortunately always worst, over the forehead and temples, then upon the *sides of the nose*, about the lips, over the chin, and spreads thence downward in quite regular progression over the body. Surfaces rendered hyperæmic, as by poultices or mustard plasters, show more profuse eruption. The *hands and fingers* furnish the next most favored surfaces. The eruption disappears upon pressure, yielding to palpation a *sense of hardness*, as of shot under the skin. It is always discrete at first. By the sixth day the papules contain fluid. They become *vesicles* and protrude like half-peas. These vesicles are peculiar in showing later a central depression or

umbilicus, which is most marked just before the vesicles change into pustules. The depression is explained in this way: The vesicle is not a single sac. It is reticulated—*i.e.*, many-celled—in structure, so that puncture evacuates only part of its contents, and the bands which form the reticula hold down the surface more firmly at one point, perhaps the site of a hair follicle, sweat gland, or firmer strip of connective tissue. Effusion takes place between the upper and lower layers of the epidermis with the dissolution of these bands. In three days more the umbilicus disappears, the vesicle becomes a *pustule* which is full, round, and large; the half becomes a whole pea. With the coalescence of pustules walls are broken down, dissolved, and eroded. The eruption becomes *confluent*.

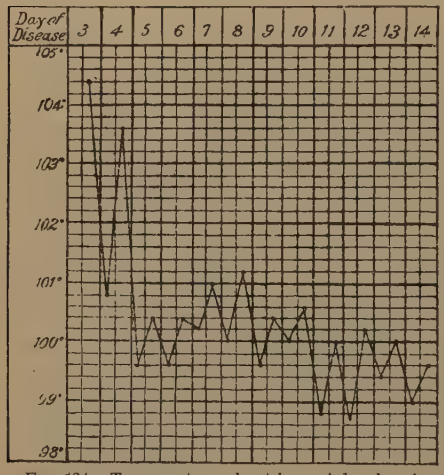


FIG. 134.—Temperature chart in variola, showing secondary fever (Moore).

The eruption of small-pox appears also on the inside skin, *the mucous membrane of the mouth, pharynx*, and sometimes deeper structures. It may be nearly always discovered in the fauces, over the palate and tonsils, and sometimes on the inner surfaces of the lips and cheeks. Occasionally it invades the larynx. Ulcers may form in the larynx, with affection of the cartilage, perichondritis, and œdema of the glottis. In a bad case the tongue, which seldom shows any sign of eruption, is swollen to such an extent as to protrude from the mouth, and salivation may be profuse. The affection may also extend from the throat to the nose, which it may block from behind, and subsequently involve the Eustachian tubes and middle ear. Mucosæ of other parts of the body are rarely attacked.

The course of the temperature in variola is characteristic. The *fever* reaches its height, as stated, with the period of eruption. So soon as the eruption has covered the body the *temperature* begins to subside, and *falls* often nearly to the normal grade within thirty-six hours. With the subsidence of the temperature the pain in the back, the nausea and vomiting, disappear, and the patient seems on the road to recovery. So soon, however, as the vesicles become converted into pustules, about the sixth to the ninth day of the disease, fever is renewed, sometimes with shivering fits, always with a rise of temperature to 102° or 103°, but rarely to the elevations reached dur-

ing the stage of invasion. This is the *secondary fever*, the fever of suppuration, caused entirely by the micro-organisms of pus. Strictly speaking, it does not belong to the small-pox process. It is a secondary effect, but is none the less characteristic of the course of the disease. With the stage of desiccation the fever again gradually subsides, to terminate by lysis in the course of the subsequent week. In the height of confluent small-pox the stage of vesiculation is represented by an accumulation of a more or less milky fluid over flat surfaces, often in irregular or zigzag shapes. The swelling is greater, as is also the corresponding deformity at the period of suppuration. The eyes and the ears are blocked, the face is enormously bloated, the scalp is lifted from the head, and the face has the appearance as if covered with a mask or heavily coated with coarse sand. With the rupture of this parchment-like coat masses of decomposing fluid ooze out, to stream down over the face and make of the patient an object so loathsome to sight and smell as to be repulsive.

Chief among the *varieties* of small-pox are the abortive and hæmorrhagic forms. The *abortive* is that variety in which the course of the disease is altered from the start. The period of incubation is sometimes shortened, the invasion may be brief, the eruption changed in various ways, or the duration cut short. This form is best described under the rather unfortunate denomination, varioloid.

Hæmorrhage may occur in the course of small-pox in no less than four distinct varieties: 1. Blood is not infrequently effused in the vesicles or pustules of patients who do not remain recumbent, who leave the bed and get up too soon in the period of convalescence. In these cases the hæmorrhage is confined almost exclusively to the lower extremities, and shows itself as petechiæ or purpura, not unlike the common form of this affection. Such hæmorrhage is purely local, due to escape of blood through paretic vessels. It speedily subsides by absorption with rest in bed; it has no prognostic gravity.

2. Reference has already been made to that petechial eruption which occurs as an initial rash on the lower surfaces of the abdomen and inner aspect of the thighs. This eruption has also a hæmorrhagic foundation. It is of diagnostic value, but has no prognostic significance.

Aside from these eruptions, 3, blood may be poured out into the true eruptions of small-pox at any part of the course of the disease. This accident occurs most frequently in cases debilitated by previous disease or bad surroundings, but sometimes, fortunately exceptionally, under totally unaccountable circumstances. The blood is effused at times into the papules, more frequently into vesicles at the period of full maturation—*i.e.*, at the height of the disease. The

clear serum becomes turbid, sero-sanguinolent, and finally the vesicle is filled with blood. Sheets of blood, diffuse and black, fill the interior of confluent vesicles and pustules, and blood appears under the skin as livid patches, vibices, and ecchymoses, in various parts of the body, to constitute what is called *hæmorrhagic small-pox*, black small-pox, "variola nigra." With this effusion of blood there is corresponding collapse. Free hæmorrhages may occur also from the various mucous surfaces, under which the patient rapidly succumbs. Should the patient survive the prostration caused by the hæmorrhage itself, he may have to face other and worse dangers. Diphtheritic deposits form in the pharynx, a scorbutic condition of the gums, or nephritis ensues and the patient may perish from uræmia. Recovery from this condition is rare; convalescence is slow and tedious.

Last among the hæmorrhagic eruptions remains to be described, 4, that particular variety in which the hæmorrhage assumes prominence over all other signs. This variety presents such distinctive features as to have led competent observers to consider it a special malady. The fact that the disease, in any of its forms, may be communicated from this form, and that the body remains infectious also after death, establishes its true nature. That this hæmorrhagic form may be distinguished from those just described, especially from the variola hæmorrhagica pustulosa, it has been given the separate name of "*purpura variolosa*"—a term which fixes in the foreground the hæmorrhagic character which literally dominates the disease. In this variety of small-pox the initial rash and the true eruption are alike wanting. Although this is the fulminant form of small-pox, it does not necessarily commence with violent signs. It attacks, by preference, the young, healthy, and strong, but does not spare the weak and debilitated. Drinkers and pregnant and parturient women are among its especial victims.

The disease begins in the ordinary way, with chill, vomiting, and rapid prostration. The stage of invasion (if it differ in any way from ordinary cases of small-pox) is distinguished by the severity of pain in the back. In the experience of the author, patients have complained of excruciating pains in the back when there was no other symptom, not even fever. Another distinctive feature is the rapidity of appearance of hæmorrhage. Should the disease occur during menstruation, metrorrhagia ensues and the nature of the disease may be thus overlooked, as the pain and the hæmorrhage may be both connected with menstruation. Hæmorrhage now shows itself under the skin, first upon the trunk, later upon the extremities, but never upon the face. The surface assumes a blood-red hue, like that of scarlet fever, and in this redness points and patches of blood appear. The eruption is usually petechial upon the extremities, and

confluent as irregular ecchymotic patches on the chest and trunk. The face is swollen, the eyes suffused and sunken and surrounded with black rings. The tongue is thick and heavily coated. The breath is exceedingly fetid. There may be elevation of temperature; sometimes there is no fever, and often the temperature is subnormal. The tendency is steadily downward, and death occurs by the end of the first week. Fortunately this form occurs in but five per cent of cases.

A peculiar variety or disposition of eruption is that described by Marson as "corymbose." In these cases the eruption shows itself in patches or clusters the size of the hand, as thickly set as possible, while the surrounding skin remains often entirely free. The patches are often symmetrically distributed upon the extremities. The variety is very rare, but, contrary to what might be expected, is very dangerous. Other singularities are verrucose, pemphigose, or miliary eruptions. They are, however, more commonly encountered in varioloid.

Varioloid is a misnomer, for the affection is not like variola, it is variola itself. Varioloid does not stand in the same relation to variola as typhoid to typhus fever; varioloid is variola in modified form. Varioloid is the lightest form of small-pox. The disease occurs in this form on account of natural insusceptibility, or on account of previous attack, formerly on account of inoculation. The great majority of cases seen in our day are due to incomplete protection by vaccination. The immunity secured by vaccination has run out, and the severity of the attack will, to a certain extent, depend upon the remaining degree of protection. A case of unmodified variola in our day is a rarity; that modified or mitigated variola known as varioloid is still frequently seen. A knowledge of the nature of varioloid and its differences from other simulating affections is necessary, that the disease be recognized at once, in protection of others. From what has been stated, it is needless to add that varioloid, mild as it may be in itself, may transmit true variola, in any, even its most fulminant forms. Most of the cases encountered in our day are so mild that the question of diagnosis concerns differentiation of varioloid from varicella as much as the recognition of variola itself. Varioloid distinguishes itself by abnormities in every phase of the disease. As most of the cases are due to incomplete protection by vaccination, the various irregularities are mentioned by Morrow when he says that "vaccination denaturalizes small-pox, deranges the original order of the disease, and effaces its most distinctive features."

It is generally assumed that the modification of symptoms is apparent in the initial stage of the disease; this view, however, is by

no means correct. The disease begins with its usual train of symptoms, and, as a rule, with its original violence. The difference concerns duration rather than degree. The initial stage is often cut short a day or two, so that the eruption may appear by the end of the first or second day. The various initial eruptions occur also in varioloid ; the petechial as an exception, the erythematous as a rule. It is a common observation that a pronounced erythematous eruption or scarlatiniform rash betokens varioloid rather than variola. Curschmann declares that we may predict, in spite of the severe depression of the general system, that the form of the disease, if erythematous, will be mild, while petechiæ will nearly always be followed by variola vera, which is not infrequently confluent. For what comfort it may bring, the author may state that the cases of petechial eruptions in Simon's triangle which have occurred in his experience have preceded, without exception, a mild, abortive attack of the disease.

With regard to the real eruption, varioloid presents the greatest variations. It may begin on the scalp, forehead, and temples, as in an ordinary case, and progress in irregular course. It may, on the other hand, show itself first on the neck and chest, or elsewhere over the trunk, to appear later on the extremities or face. As a rule it is much less abundant, so that it is nearly always discrete. There are, however, exceptions to this rule, and marked cases may show isolated patches of confluence on the face and hands. On its first appearance the eruption differs in no way from that of the more pronounced form of the disease. It comes out in spots, which are elevated into papules in the course of the first day. The papules slowly show fluid at their acuminated apices, and become thus entirely converted into vesicles as before. Here, now, the change is usually observed ; the eruption usually stops at this stage, and the vesicles, which may have become umbilicated, begin to dry up and disappear. They may fill out, as in the course of severer forms ; their contents may become turbid and opaque, and the vesicle may be transformed into a pustule ; but it is plain to see that the force of the disease is spent. Certain pustules may rupture, but the process is limited and the secondary fever of suppuration is reduced or is entirely absent. In consequence of the fact that pustulation does occur in places, with erosion and destruction of tissue, pits may be left, but they are few and far between as compared with the lesions of ordinary small-pox.

The disturbance of the general progress of the disease is marked also by irregularity. It is more common to find pustules and vesicles, or vesicles and papules, in closer proximity in varioloid than in variola. Moreover, the eruption does not last so long. Desicca-

tion begins on the fifth or seventh day, and most of the papules dry up into crusts without rupture. These crusts, as a rule, leave only pigmented traces without scars. There is often also disproportion between the severity of the fever and the eruption. There may be high fever in the presence of but ten or twenty vesicles or pustules over the body, or, *per contra*, the eruption may be almost or, in places, even confluent with but little elevation of temperature. It is plain to see that vaccination has at every point put a muzzle upon the disease.

The various transformations of vesicles and papules which may occur during the process of modification or abortion may convert vesicles or pustules into warty masses, or bullæ; or ruptured vesicles may fill with air, to constitute varieties known as variola verrucosa, pemphigosa, miliaris, ventosa, or cellulosa, etc. So of the various affections of the mucous membrane. While they may be present, or in individual cases more or less pronounced in initial stages, they rarely assume prominence or give rise to serious complications.

Complications which occur in the course of small-pox do not differ much from those of equally grave acute infections. Sufficient mention has already been made of the lighter affections of the pharynx and larynx. It remains to be said that gangrenous processes, œdema of the glottis, perichondritis occur in exceptional cases. Stenosis from either of these causes may necessitate intubation or tracheotomy.

Bronchitis belongs to variola, as to most of the exanthemata. It is very liable to extend in childhood, to infect the finer bronchial tubes and result in broncho-pneumonia. Pleurisy is by no means so common, but is by no means rare. Pericarditis, endocarditis, endometritis, meningitis, are not uncommon complications in grave cases. Affections of the joints, arthritis, pyæmia, septicæmia, are much more frequent.

Small-pox occasionally affects the eye; conjunctivitis, keratitis, affections of the lids, are the most common lesions. Disease of the choroid and retina occurs in exceptional cases. Panophthalmitis with destruction of the globe was not uncommon in ancient times. Eye complications in our day are neither frequent nor severe. In all his remarkable experience Hebra saw eye complications in only one per cent of five thousand cases of small-pox.

By extension of the inflammation of the fauces and pharynx the middle ear may be attacked, to result in otitis or otorrhœa with subsequent anchylosis of bones and deafness. Phlegmonous inflammations, gangrene of the skin, furunculosis, occur frequently in confluent cases, and local and diffused inflammation of the brain and

cord, paralysis, bed sores may nearly complete the possible complications.

The *diagnosis* of the disease rests upon the following points: the possible *existence of other cases*, the *history* of sufficiently recent protection by vaccination. The mere existence of a scar is no evidence of protection. The worst case of purpura variolosa encountered in the experience of the author had three well-marked cicatrices upon the arm as evidence of previous vaccination. Then it is observed that the illness sets in *suddenly* and is usually *severe* from the start. Strong men stagger as if drunk. The temperature rises rapidly. *Pain in the back* is peculiar in its intensity; *initial eruptions* may be characteristic. The true eruption appears upon the *third day* after the initial chill. It is maculated, not punctate like that of scarlatina, but darker than the scarlet of scarlatina and lighter than the dusky hue of measles. It is seen *first upon the scalp* and upper part of the face, spreading downward regularly and rapidly; it does not spare the nose or region of the mouth. It yields a peculiar feeling of hardness, as of shot under the skin. Elevation into papules occurs during the first day. The diagnosis becomes nearly certain when the papules by the third day change into *vesicles*, some of which subsequently become *umbilicated*.

Small-pox is one of the most grave of the acute infections which survive from the pre-sanatory period of civilization. We see it for the most part as a mere relic or rudiment of its former self. There is lacking with us that element of multitudinous infection which gives volume and virulence to a disease. Nevertheless even in its modified form it preserves its character as a grave infection, and it may hence be confounded with any of the infections of equal gravity, especially with any attended with an eruption.

Disregarding the eruption for the present, because not manifest at the start, mistakes have thus arisen in connection with meningitis, pneumonia, and typhus fever. *Meningitis*, especially the cerebro-spinal form, *pneumonia and typhoid fever*, begin, like small-pox, in the midst of health, with violent chill, rise of temperature, and rapid prostration. Gastric symptoms, vomiting or nervous shock, especially, in children, convulsions, may announce the onset of any of these infections. In the absence of an epidemic or the history of exposure, in the absence also of adequate protection by vaccination, the diagnosis must sometimes be held in abeyance for twenty-four or forty-eight hours until distinctive signs of one or the other of these diseases are manifest. Meningitis distinguishes itself by hyperæsthesia, opisthotonos, and herpes, as well as by its irregular temperature curve. *Pneumonia* is early characterized by pain in the side, cough with glutinous and rusty sputum, and increase of respiration out of pro-

portion to the pulse. But the diseases which are most frequently confounded with small-pox are those which are attended with an eruption, and chief among these is *typhus fever*. But typhus fever has a history of importation which may be traced, or prevalence which may be known. It begins often like small-pox, suddenly, with a severe chill, in the midst of health, and shows an eruption on the third day. The eruption of typhus, however, appears first upon the body, chest, and abdomen in the form of maculæ, which soon become petechial. The eruption of small-pox appears first upon the scalp and forehead, and progresses over the face before it appears upon the body. It shows itself in the form of maculæ, which soon become papular, vesicular, etc. The petechiæ which may occur in small-pox occur on the legs or thighs, or in the course of a hæmorrhagic form. Vesicles, especially umbilicated vesicles, are never seen in typhus fever. There is also characteristic difference in temperature, which subsides with the appearance of the eruption in small-pox, but persists unaffected for several days or as long as a week in typhus fever.

Confusion with *typhoid fever* is less pardonable. Typhoid fever begins insidiously, requiring the time of a week to reach the elevation of temperature of small-pox in a day or two. The cloud about the brain, which belongs both to typhoid and typhus fever from the start, is not present in small-pox until the last stages of the disease. Typhoid fever shows abdominal symptoms, roseola on the seventh to tenth days, meteorism, gurgling, diarrhœa, etc., absent in small-pox.

A light case of small-pox may be regarded as measles, and a bad case of measles as small-pox. Consequently the separation of small-pox from *measles* is the most frequent problem submitted to the practitioner. The future of the case, the safety of the community, the reputation of the physician, depend upon the proper solution of this problem Here, too, help may be had by a knowledge of the history of the case as to the existence or absence of an attack of measles or small-pox, the period of the last successful vaccination, the prevalence of either disease in the community. As for measles, it is always present in cities. Thanks to the popular fear of small-pox, knowledge of its existence is early promulgated by the health authorities. Nevertheless sporadic cases steal in at times unannounced. In the experience of the author with the management of a large dispensary practice, small-pox was twice introduced into Cincinnati by the peripatetic philosophers commonly called "tramps." These cases formed centres of infection. Knowledge of the period of exposure—*i. e.*, the period of incubation—is of little value. The stage of invasion is much milder in measles than in even modified

forms of small-pox, for, as has been stated, varioloid may be announced with symptoms as severe as those which distinguish the onset of variola vera. The chill is less severe, the fever is less high, the prostration is less profound in measles as a rule. There are, of course, exceptions on both sides. The eruption appears on the third day of small-pox, on the fourth day of measles. The maculæ of measles are bigger than those of small-pox. They appear also upon the back almost at the same time as upon the face, whereas the eruption of small-pox much more uniformly appears upon the face and reaches the back only later in its advance over the body. The maculæ of measles are softer than those of small-pox. Rhazes said, nearly a thousand years ago, the difference between the two he found to be "that measles are red and appear only on the surface of the skin without rising above it, while the small-pox consists of round eminences. When these eminences appear, fix your attention on them, and, if you are in doubt as to the disease, do not express any opinion about it for a day or two; but when there are no eminences you must not give as your opinion that the disease is small-pox." And Collie, a recent writer, observes: "A case of small-pox severe enough to simulate measles imparts to the hand, in passing it over the surface, a hardness and furrowed roughness, as that produced in passing the hand over a piece of corduroy; whereas in raised, confluent measles it is that of passing the hand over a piece of velvet." The catarrhal symptoms, more especially the coryza, which may exist in both affections, are wont to be more prominent in measles at the start, but persist longer in small-pox. The course of the temperature is characteristic in the two diseases. The appearance of papules or vesicles soon dissipates all idea of measles.

The severity of the sore throat, the backache, and the scarlet color of the rash, which appears as minute points as early as the second day after the initial chill, distinguish *scarlet fever*. The grave hæmorrhagic form, "purpura variolosa," is recognized by the extreme severity of pain in the back, as well as by the petechial character of the eruption, free hæmorrhages, etc.

Papular eczema is irregular in its distribution, unattended with fever or involvement of the mucous membranes. The same exceptions apply to *erythema*, *acne*, and *herpes*. Only the most superficial observer could consider these eruptions variolous.

Syphilis may show pustules to closely resemble discrete variola, including even the process of umbilication; but the absence of the initial signs—chill, fever, pain in the back, etc.—the history of syphilis, or associated evidence elsewhere, render the diagnosis easy as a rule.

The separation of variola and varicella will be discussed under "Varicella."

All cases concerning which there is any doubt should at least be isolated for a time until sufficient protection can be offered to others by vaccination. Marson says of his experience in the London small-pox hospital: "Upward of twenty diseases have been mistaken within the last few years, in the early stage of the disease, for small-pox, and the patients have been sent, as having small-pox, to the small-pox hospital."

The *prognosis* is largely determined by the last successful vaccination. The next most important factor is the determination of the form of the disease. The third is the age of the patient. Small-pox in infancy has a mortality which is put at ninety per cent. Almost equally grave are the cases which occur in pregnancy and the puerperium. The greater danger which is thus imparted to the female sex is counterbalanced in the male sex by the mortality of the disease among drinkers. The percentage runs high, again, in advanced age; nearly seventy-five per cent of old people, unprotected by vaccination or previous attack, succumb to the disease.

Severe symptoms on the part of the nervous system are of evil omen, but to a less degree in children than adults. Trousseau laid great stress upon tumefaction of the extremities, what he calls "red œdema," which should set in at the end of the ninth day with acute pain; with Sydenham, Morton, Van Swieten, Borsieri, he attaches great importance to it in a prognostic way. He says: "Swelling of the hands and feet is such a necessary phenomenon in confluent small-pox that patients almost invariably succumb where it is absent, unless there be a great critical discharge by the kidneys or bowels." Profuse suppuration in the skin is a sign of danger. Hæmorrhagic small-pox is very serious; less than one-half the cases recover. But the prognosis is not unfavorable because of initial petechiæ, which may show later upon the legs of patients who try to get about too soon. Purpura variolosa is always fatal. The mortality of the unvaccinated ranges, even in our day, at twenty to forty per cent.

Prophylaxis.—Vaccination, if it could be enforced, would render superfluous all other prophylaxis, including isolation. Inoculation, which it substitutes, has only historic interest. Vaccination and revaccination, if it could be made compulsory, would eventually eradicate the disease; thus but a single fatal case of small-pox has occurred in the German army during the past twenty years. Unfortunately, however, vaccination cannot be made compulsory in our country, "where the cry of infringement of personal liberty is the shibboleth of the demagogue" (Foster), so that patients must still be isolated and sick-rooms disinfected. A temperature of 400° F. is fatal to small-pox. The organisms of the disease are destroyed by sulphur

in sufficient concentration. That this process may be properly brought about, it must be done by health authorities. All combustible material should be consumed, if it may not be subjected to the antimycotic action of live steam; walls should be rubbed down with bread; floors scrubbed with a solution of corrosive sublimate 1 : 1000; doors and windows should be closed, and sulphur, four pounds to every 1000 cubic feet of air, should be burnt to bring about perfect fumigation; at the end of two days the chamber may be thrown open and thoroughly ventilated for two weeks. Bedding, clothing, curtains, etc., after subjection to superheated steam, should be suspended in the open air, day and night, for a week.

The dead body should be subjected to immediate interment, as infection is disseminated from its surface up to the period of decomposition. In the interval between death and burial the body should be enveloped in a sheet saturated in the solution of corrosive sublimate 1 : 1000. Transportation should be permitted only when a body is put in an air-tight metal case. In the experience of the author an epidemic was once developed at a distance in a country town by neglect of this precaution.

Treatment.—If seen early the patient should be vaccinated at once. Vaccination modifies variola in the early stage of the disease. After the fourth day vaccination is useless. Marson puts it positively: "Suppose an unvaccinated person to be exposed to small-pox on Monday; if he be vaccinated as late as Wednesday the vaccination will be in time to prevent small-pox being developed; if it be put off until Thursday small-pox will appear, but will be modified; if the vaccination be deferred until Friday it will be useless—it will not have had time to reach the stage of areola, the index of safety before the illness, and indications of small-pox begin." Curschmann does not subscribe to these points. He declares that he has seen, in cases in which vaccination was practised, that infection with vaccinia and small-pox pustules developed side by side. He doubts whether vaccination can render the disease even milder in its course. Nevertheless so long as there is doubt the patient should have the possible benefit of early vaccination.

Treatment, in the absence of a specific, is wholly symptomatic: Rest in bed in a thoroughly ventilated room at a temperature of 65° F., as determined by a thermometer at the head of the bed; light but sufficient covering; cool drinks—water, lemonade, Selters water, in sufficient quantities; fever diet—milk, soups, gruels. Thus much we owe to Sydenham. What it must have effected may be learned by what it substituted. The contrast is shown in a chapter from the practice of Diemerbroeck: "Keep the patient," says Diemerbroeck, "in a chamber close shut; if it be winter, let the air be corrected by

large fires; take care that no cold air gets to the patient's bed ; cover him over with blankets. Never shift the patient's linen till after the fourteenth day, for fear of striking in the pock to the irrecoverable ruin of the patient. Far better it is to let the patient bear with the stench than thus be the cause of his own death." Trousseau is right when he says: "If the second epoch in small-pox was introduced with inoculation, and the third with vaccination, the first was introduced with the treatment of Sydenham."

Fever above 103° can best be combated by frequent baths, or by phenacetin or salipyrin gr. x., or antipyrin gr. v., or in half of these doses in childhood. For throat complications, steam from an atomizer, simple or medicated with boric acid gr. xv.–℥ iv., thymol gr. xv., alcohol and water āā ℥ ij., or carbolic acid or creosote ʒ ss.–℥ i. alcohol to ℥ iij. water, or, with less efficacy, gargles of the same strength. Inhalations may substitute all local applications in very young or refractory children. Chloral, gr. ii.–x., becomes a necessity in periods of unrest, nervousness, insomnia. It has no equal in the relief of nausea and vomiting. For jactitation or extreme nervous distress it may have to be substituted by Dover's powder gr. ii.–v. Frequent ablutions of tepid water, ointments, diachylon ointment, plasters, mercurial plaster, or opening pustules after the manner of the Arabs and touching them with nitrate of silver, or, better, with equal parts of carbolic acid and glycerin, or touching the tops of *beginning* pustules—*i.e.*, mature vesicles—with a camel's-hair brush dipped in carbolic acid, best prevent or limit pitting. Xylol internally is said by Zülzer to have the power of coagulating the contents of pustules, but the claim was not at all substantiated by subsequent trial.

Where tissue is destroyed cicatrization must result, and, in consequence of it, pits and scars. Means to prevent deformity, to be effectual, must therefore be brought into use before the stage of suppuration is complete. Nothing can prevent pitting in an established confluent small-pox. The best clinicians are content with frequently renewed water dressings, made antiseptic as much as may be with sublimate solutions 1 : 5,000–10,000 or with one-per-cent solutions of creolin. The whole question, with all the other horrible evils of small-pox, sinks into insignificance and slinks away, like the devil at sight of the cross, when brought face to face with vaccination.

VACCINATION.

Vaccination (*vacca*, a cow); vaccinia; cow-pox.—The inoculation of man with cow-pox in prevention of small-pox. The promulgation of vaccination by Edward Jenner in 1798 constitutes one of the great epochs in the history of mankind, in that from this period the tropical plague variola, which overran and literally decimated Europe and

the rest of the world, was reduced to the trivial malady varioloid, which is, uncomplicated, never fatal.

History.—Jenner was a medical apprentice at Sodbury when he became acquainted with the popular belief in the protective influence of cow-pox, a subject which he was unable to dismiss from his mind. He visited Gloucestershire, and made observations and prosecuted the investigations for himself. He found that there existed a widespread belief amongst the dairymen that certain individuals who had contracted sores upon their hands from contact with sores on the bags of cows were never attacked with small-pox. Much contradictory testimony presented itself at first, and many disheartening exceptions were found.

May 14th, 1796, is the memorable day when Edward Jenner transferred cow-pox from vesicles on the hands of Sarah Nelmes, a dairymaid, by means of two superficial incisions, into the arms of James Phipps, a healthy boy eight years of age. The cow-pox ran its ordinary course, and a subsequent inoculation with small-pox on the 1st of the following July failed to produce the disease. This was the first attempt of a simple practice which has within less than a century, and without radical correction or real improvement, afforded to all mankind protection from the ravages of small-pox. A number of children subsequently vaccinated in succession, "one from the other," were, after several months, exposed to the infection of small-pox, "some by inoculation, others by variolous effluvia, and some in both ways, but they all resisted it." There is evidence that Jenner worked with this subject, encountering and overcoming obstacles and opposition on every hand, for over twenty years before he announced it to the world, and it is known that fully two years elapsed between the first vaccination and the publication of his paper. It was entitled an "Inquiry into the Causes and Effects of the Variolæ Vaccinæ, a Disease discovered in some of the western counties of England, particularly Gloucestershire, and known by the name of Cow-Pox."[1] Jenner lived to see all opposition overcome, while the procedure was at once adopted all over the world, and to receive universal honors and emoluments as the greatest benefactor of his kind.

Cow-pox is an infectious disease which appears in dairies from time to time, often at wide intervals of both time and space, and shows itself first in some particular cow, usually a young cow, a heifer in her first milk. It never appears first in other cattle than milk cows, and never shows itself elsewhere than on the teats or at adjoining parts of the bag, as they may be infected by direct pressure. It appears in the form of scattered papules, which in the course of a

[1] London, 1798, quarto; 1800, octavo; 1801, octavo.

few days show fluid at their apices, to become transformed into distinct vesicles. These vesicles are broken by the hands of the milkers, and the disease is thus disseminated in the course of a few weeks, sometimes months, throughout the entire dairy.

It is a matter of secondary importance, so far as the protective efficacy of the virus is concerned, whether so-called animal or human lymph be employed in vaccinating, for it is the same virus in every case. Animal lymph "takes" slower and harder, but compensates for these objections by freedom from any possible infection with tuberculosis, syphilis, or other disease, excepting possibly erysipelas.

Bacteriology.—Vaccinia alone would seem to offer all the conditions essential to easy separation of characteristic elements, but the numerous attempts in this direction have not yet been rewarded with success. The efforts of Schulz resulted rather in the conversion of active into useless matter. Garré was not able to induce vaccinia with the micrococcus he considered peculiar to the affection, and the efforts of Tenholdt and Dougall were not more successful with the micrococci isolated and cultivated from lymph of proven potency.

The *proof* of the degree of *protection* is seen at a glance by observation of statistics in countries and cities where they are most accurately kept. Thus in Sweden the mortality from small-pox in the twenty-four years before the introduction of vaccinia (1801) was 2,050 per million annually; after vaccination, 158 per million. Drysdale says of Berlin that the mortality in that city during the epidemic of 1872–73 rose to 243 and 262 respectively per one hundred thousand inhabitants. Thereupon vaccination in the first year of life was made compulsory, and revaccination in the twelfth year of life, with the result that in the first year of enforcement (1875) the mortality fell to 3.6 per one hundred thousand, to 3.1 in the year 1876, to 0.3 in 1877, and so on for succeeding years down to 1883 with an average of 1.7 per one hundred thousand. The nearly absolute protection of vaccination is shown again by comparison of cities in which vaccination and revaccination are obligatory and optional. Thus, according to the Berlin Health Office, the mortality of small-pox per one hundred thousand inhabitants in 1888 was in Dresden 0, in Berlin 0.07, in London 0.6, in Munich 0.75, in Hamburg 3.58, in Paris 9 0, in St. Petersburg 15.30, in Vienna 26.15, in Prague 55.49. Corbally reports that the vaccinated children of Sheffield, 1887–88, had, as compared with the unvaccinated children, a twenty-fold immunity from attack, and a four hundred and eighty fold security against death by small-pox. These facts render further statements superfluous, but a few points may be added from army life. Army statistics, on account of accuracy, are especially valuable. Schulz shows that since

the operation of the German law the annual average cases of small-pox per one hundred thousand was, in the army of Germany, 4.94; of France, 169.72; of Austria, 374. During the Franco-German war (1870–71) the mortality of small-pox in the unvaccinated French army was 23,469, while that of the vaccinated German army was but 261. As stated elsewhere, there has been reported but a single case of death from small-pox in the German army since 1874.

The immunity conferred by vaccination does not, as Jenner

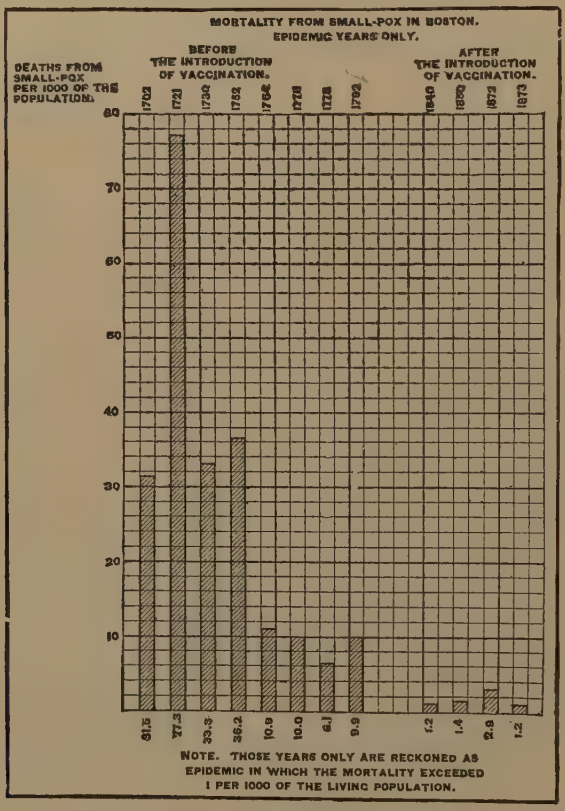


FIG. 135.

hoped, last for life. Therefore *revaccination* becomes a necessity after a lapse of years. The best proof of this necessity is furnished in the fact that revaccination "takes" as a rule; thus among the soldiers of Prussia, Russia, and Denmark in 50 to 70 per cent of cases. Heim found in five years but one case of varioloid among 14,384 revaccinated soldiers and but one case among 3,000 civilians, small-pox meanwhile prevailing in three hundred and forty-four places in which these people lived.

Moreover, the number of extensive epidemics have diminished from 71.4 per century previous to vaccination, increased to 84 during inoculation, to 24 since vaccination.

Protection begins on the fourth day after the introduction of the virus, and is perfect on the ninth day. The degree of protection, independent of revaccination, is determined to considerable extent by the success of the operation and by the *quantity of matter* introduced—*i.e.*, by the *number of places vaccinated.* Thus, according to Marson, the average mortality of small-pox among all vaccinated persons is 5.24 per cent, while that of individuals showing perfect cicatrices is about one-half of one per cent. In 6,000 cases of small-

DEATHS FROM SMALL-POX IN BERLIN AND VIENNA DURING THE YEARS 1870 TO 1886. COMPULSORY VACCINATION LAW ENACTED IN BERLIN IN 1874. OF EVERY 100,000 INHABITANTS THERE DIED OF SMALL-POX IN—

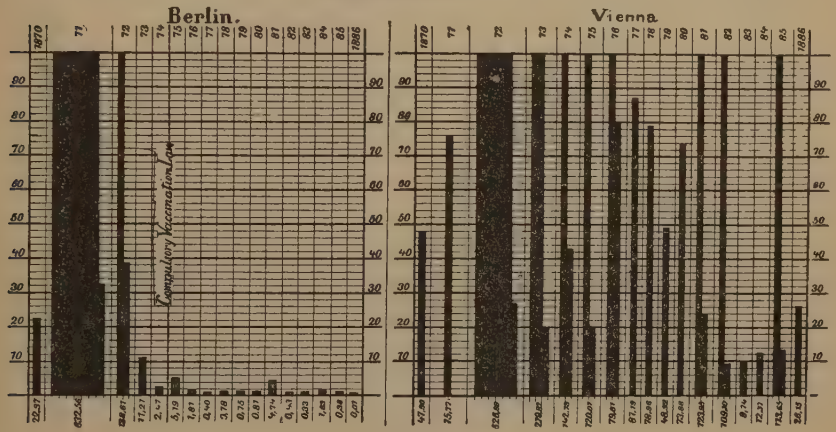


FIG. 136.

pox after vaccination observed by Simon in twenty-five years, the percentage of death among individuals without cicatrices was 21.75 per cent; with one indefinite cicatrix, 12 per cent; with one typical cicatrix, 4.25 per cent; with two cicatrices, 4 per cent; with three cicatrices, 3.25 per cent; with four or more cicatrices, 3 per cent. This fact finds additional proof in the observation that the protection of vaccination, however great, is not so thorough and sustained as that offered by an attack of small-pox itself, whether contracted by ordinary exposure or by inoculation. Vaccination, and revaccination once or twice in later life, as at puberty and maturity, protect for life absolutely. The exact protection by single vaccination cannot be definitely established. It varies in different cases. If revaccination "takes," the individual was certainly liable to take small-pox. The operation is so simple and inexpensive as to justify its practice at stated intervals, and inasmuch as no case of small-

pox contracted within seven years—twelve in Germany, according to the report of the Health Office—after a successful vaccination stands upon authentic record, this period may be put down as the proper interval for absolute protection, with the injunction in all cases that revaccination be performed with every exposure seven years after the last successful vaccination.

Objections.—As already stated, it is a matter of indifference whether use be made of human or bovine lymph. Objection was raised against human lymph on the ground that it had undergone degradation. Hebra declared, however, that the lymph used in Vienna produced the same effect as when first introduced. Chapin, of Rhode Island, made the same observation of matter that had been employed for twenty-six years upon nearly forty-seven thousand persons. With proper care in the selection and preservation of lymph, it undergoes no diminution in potency and protection.

But a valid objection to the use of human lymph is the possibility of the conveyance of other disease. Thus it has been asserted that *tuberculosis*, *syphilis*, and *erysipelas* have been transmitted in this way. The possibility of introducing these diseases with vaccination is unquestioned, though, as a matter of fact, *tuberculosis* has never been transmitted in this way. The few apparent cases recorded meet with truer interpretation as localizations of bacilli tuberculosis previously latent in lymphatic glands (scrofula). As to syphilis there is no doubt. It is admitted that the disease has been introduced in this way by the use of virus from syphilitic infants. It was for a long time maintained that this disease could not be thus conveyed unless blood, pus, or matter other than the pure lymph had been introduced with the lymph itself. It is, however, now determined that the virus of *syphilis* may be conveyed with the pure lymph of vaccinia virus. Robert Cory, chief of the Natural Vaccine Establishment, England, settled this question with a self-sacrifice that finds but too frequent following in other fields. He selected only clear, pure lymph from children who showed unmistakable evidence of the disease in the stage of active eruption. With this lymph he vaccinated himself on several occasions. After repeated failures he succeeded in producing in the course of three weeks, after a last inoculation, a distinct eruption, followed in irregular course by sore throat and other unmistakable evidences of syphilis (Plant). The difficulty as well as the possibility of transmitting syphilis in this way is proven in this experiment. The smallest precaution as to the selection of subjects suffices to procure protection against this disaster. The transmission of syphilis is easily avoidable by taking matter only from healthy children at least six months old, the ultimate limit of "tardy" inherited syph-

ilis, and all possibility is absolutely excluded by the use of animal matter, as syphilis is an exclusively human disease.

Erysipelas (streptococcus) may be introduced with vaccination, or may fall later upon the broken surface. The accident is rare in any event, occurring in the practice of the author but twice in twenty-five years, but has been sufficiently frequent during the prevalence of an epidemic of erysipelas—as in Boston, 1854—to justify the suspension or postponement of vaccination.

Time and Technique.—Vaccination should be done at the age of three to six months, or, in the presence of an epidemic, at any time, even at birth. In case of failure the operation should be repeated at intervals until it is crowned with complete success. Revaccination at stated intervals—at puberty, maturity, or at any time during an epidemic—robs the question of the value of the kind of virus, or the number of vaccinations at one time, of practical interest.

Points of selection for the operation are about the insertion of the deltoid or the junction of the heads of the gastrocnemius muscles. In protection against future carelessness regarding revaccination the

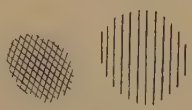


Fig. 137.

Fig. 138.

Fig. 137.—Strokes and cross-strokes for vaccination.
Fig. 138.—Bone point for vaccine virus.

matter may be introduced at three places, at the angles of a triangle (horizontal insertions at the shoulders permit concealment by a narrow sleeve), at least half an inch distant from each other. Six or eight parallel tracings or strokes, with as many cross-strokes, with the point of a knife, so light as to expose the superficial lymphatics and draw little or no blood, afford the best wound, upon which the moistened bone surfaces may be gently rubbed.

Susceptibility is universal. There is no such thing as insusceptibility to vaccination. Seaton never saw it in more than nine thousand cases at the Black Briars National Vaccine Station. Cory confirms this statement with reference later to bovine lymph, and Robertson declares that so-called constitutional insusceptibility is usually a confession on the part of the operator that he has not ascertained the cause of his failures.

Pathology.—The true vaccination shows all the characteristics of a single typical small-pox pustule. At the end of forty-eight hours the surface of insertion is marked by slight redness and swelling to the size of a large papule, upon the summit of which develops, by

the third or fourth day, a small vesicle filled with a clear fluid. This vesicle is a reticulated sac, the puncture of which, as for the collection of lymph, discharges by slow oozing its fluid contents. It reaches its maximum size by the seventh or eighth day, at which time it is umbilicated and surrounded by a ring of inflamed tissue—the areola—which continues to enlarge for two days, to attain in full development a diameter of one to three inches. The contents of the vesicle now begin to grow somewhat opaque (pus), to present the appearance on its inflamed base quaintly described by Jenner as "the pearl on the rose." The areola is the evidence of a successful vaccination. By the tenth day the serum is changed into pus; the vesicle has become opaque and yellow; its centre shows inspissation in the form of a crust, which, by the fourteenth day, extends to convert the whole pustule into a hard, dry mass. The crust falls spontaneously by the twentieth to twenty-fifth day, to leave, as a result of tissue destruction, a characteristic scar. The cicatrix of vaccinia is a more or less circular depression marked by minute pits and radiating lines. It should measure in its diameter fully one-third of an inch. Red or pink at first, its color gradually fades to the bleached appearance of cicatricial tissue, to remain as a mark for life, or to gradually disappear, in the course of adolescence, to the faintest trace. However pronounced, a cicatrix, it is needless to state, is evidence only of destruction of tissue, not of permanent protection against small-pox. The writer recalls a malignant case of purpura variolosa in a young woman whose arms were marked by typical cicatrices, relics of successful vaccination in early childhood. Slight fever, fretfulness, headache, insomnia, restlessness, disturbances of digestion, lymphangitis (as marked by swelling of the axillary glands), may be present for a few days about the time of maturation of the vesicle, to subside rapidly during the period of incrustation. More extensive inflammation, dermatitis, or ulceration indicate mixed infection. The constitutional signs are mildest in infancy, and increase in severity with advancing years.

Delay in the appearance of the vesicle, even to the end of a week, does not preclude success, provided the subsequent phenomena appear in course. Accelerated, abortive, so-called "spurious" vaccinations differ in various ways, and furnish only partial, limited, or no protection.

VARICELLA.

Varicella, or varicellæ, diminutive of *varus*, pimple, pock; chicken (French, *chiche;* Latin, *cicer*, insignificant) pocks or pox; water pock, wind pox; variola notha, spuria, false pox.—A trivial, acute infection of childhood, distinguished by a long period of incubation,

absence of prodromata, slight fever, a vesicular eruption varied in size and short in duration, as a rule without complications or sequelæ.

History.—Chicken-pox met its first description under the term crystalli by the Italian anatomists, Ignassias (1575), Guido Guidi (Latin, Vidus Vidius, as in the Vidian canal) (1585), and received its present unfortunate name from Vogel (1764).

Fuller (1730) and Heberden (1767) made the first attempts to separate it from variola (varioloid), with which it had been hitherto confounded, and has been since by many authors (Hebra, Thompson) "with inconceivable persistence" (Thomas)—a mistake which resulted in complete confusion regarding the nature of both affections, and in reproach and disrepute of vaccination in its early history.

The recognition of the fact that an attack of one secures future immunity from itself, but does not protect against the other, finally led to a distinct separation of the two diseases. Confirmation of this view was also obtained in the fact, as stated, that vaccinia does not prevent varicella, nor varicella vaccinia. Czakert, after three failures in the ordinary way, succeeded in vaccinating a boy, æt. four, by introducing lymph into the interior of vesicles during an attack of varicella.

Etiology.—Varicella appears in sporadic and endemic, rarely epidemic, form, but epidemics never assume the range nor show the intervals of measles and small-pox. The disease does not die out entirely in large cities, but assumes somewhat of epidemic proportion once or twice a year on the opening of schools and kindergärten. It is confined exclusively to childhood (exceptions by Heberden, Gregory, and Seitz) up to the age of twelve, and is rare after ten. The short-lived contagious principle, probably from the vesicles, is believed to be inhaled (*contagium halituosum*). Infants are never born with chicken-pox.

Bacteriology.—Inoculation experiments fail oftener than they succeed. Thus Hesse failed in eighty-seven, succeeded in causing a local eruption in seventeen and a general eruption in nine cases. Steiner claims to have succeeded eight times in ten trials, but was unable to propagate the disease from any case. Tenholdt found in the contents of vesicles a micrococcus which, inoculated in man, produced light redness and swelling like that of spurious vaccinia, and in one case a vesicle smaller than a sudamen, the affection remaining local. Pfeiffer found in fresh vesicles of thirty cases, without exception, a parasite (proteid) showing an amœboid stage, a cystic stage, spore formation, and, after the development of numerous spores, a return to the amœboid stage. Inoculation with contents of vesicles showed, three times in five days, a localized, circum-

scribed varicellar exanthem, recurring scattered up to the eighth day. The parasite could not be cultivated upon any culture soil.

Incubation varies from eight to seventeen days.

Symptoms.—Prodromata, in some form of light malaise, occur only very exceptionally. In these rare cases they may assume prominence, and thus there may be headache, vomiting, high fever. Henoch once saw a case begin with convulsions.

The disease is announced, as a rule, by the *eruption*, which shows itself in the form of spots of hyperæmia, in the centre of which appear, in the course of a few hours, distinct but slightly elevated *vesicles*, which attain their greatest circumference in the course of three to twenty-four hours. The vesicles contain a clear, sticky serum of neutral or alkaline, never acid (as in sudamina) reaction, which fully distends the vesicle, and which exudes slowly, but not wholly, on puncture of the sac. The serum shows under the microscope a few pus cells, which, when exceptionally present in greater quantity, may make the vesicles appear like drops of wax. In lighter cases, without halo, the patient looks as if sprinkled with "drops of water" (Fagge).

The eruption shows itself first upon the *neck and chest* (face, according to Thomas), to spread subsequently over the face and scalp, trunk and extremities, and shows itself always in successive crops, to the number of ten to fifty, or as many as two hundred to eight hundred, over the whole body, irregularly, never uniformly or at once.

Vesicles *vary* also *in size*, usually from a pinhead to a pea, exceptionally from a dime even to a dollar. These large vesicles are, however, always lax, never full, as is the case in the blebs of burns, blisters, and pemphigus. Distinct, isolate, and irregular elsewhere, they may show aggregation, like zoster, upon the extremities, but are very rarely confluent anywhere. They are very *superficial*, lifting only the upper layers of the epidermis, and penetrate to the rete Malpighi in only exceptional cases. Hence they but rarely show an umbilicus, and seldom leave a scar. Yet one or two scars are sometimes to be seen on the forehead, eyelid, or other part of the face, and a few such scars may produce as much deformity as a case of varioloid. In fact, the isolated chalk-white scars of the face in children are nearly always relics of varicella.

The eruption may also show itself on various *mucosæ*, as in the eyes, to produce *conjunctivitis*, *keratitis;* in the mouth and palate, to cause *stomatitis;* in the pharynx, to lead to more or less *dysphagia*, and induce, at times, swelling of the cervical glands; on the vulva and prepuce, where it may show itself as a string of vesicles on the inner aspect of the labia majora, or at the frænum, to give rise to *pain in*

micturition. Vesicles which appear in the mouth, especially on the tongue, are readily broken, to show irregular, ragged abrasions, sometimes with aphtha-like surfaces.

A slight *rise of temperature*, maximum 102° (exceptionally 106°, Heberden), with associate symptoms of fever, headache, insomnia, anorexia, nausea, etc., attends or may attend the eruption, to continue with it two or three or, exceptionally, as long as five days. Defervescence is by crisis, without subsequent elevation or interruption. Very light cases may show no fever at all. Relapse and recurrence are possible but not probable.

Hutchinson described a grave form of varicella which occurred most commonly in weakly, ill-nourished children. The vesicles, instead of drying up in the ordinary way, grow blacker and larger, to present the appearance of round, black spots, of the diameter of an inch or more, scattered over the body. These crusts cover underlying ulcers, which sometimes extend through the skin and subjacent muscular tissue. These cases are said to be very fatal. They may be attended with eye complications, irido-choroiditis and loss of sight. This variety must be exceedingly rare, as it is not mentioned by other authors, except Eustace Smith, who connects it with the curious tendency to gangrene seen in certain children. It is probably the result of a mixed infection, and has no more to do with genuine varicella than a coincident erysipelas or other dermatitis. Hæmorrhagic varicella has been observed (Andrew) as a special complication in cachectic cases. Varicella may occur in connection with other infections, with measles, scarlet fever, diphtheria, pertussis, and even with variola (Sharkey).

Diagnosis.—Inasmuch as varicella was so long, and is often yet, mistaken for variola (varioloid), the question of differential diagnosis assumes supreme importance. The diagnosis demands: 1. A knowledge of the existence of either disease in the vicinity or community, and a definite *history* of the pre-existence or absence of either in the individual, together with the period of the last successful vaccination. 2. The *age of the patient*, as variola occurs at all ages, and varicella is almost confined to childhood. 3. Variola is preceded by *prodromata*—malaise, fever, headache, backache, sometimes by initial rashes—and is attended by a characteristic eruption on the third day; varicella announces itself with its eruption, without prodromata. The most anxious mothers seldom notice illness of any kind until the eruption appears. The physician is called to decipher the eruption. 4. Varicella *appears*, as a rule, *first* upon the back, neck, and chest, or, if upon the face, irregularly over it, and irregularly over the body. Variola appears, as a rule, first upon the face, forehead, to extend over it regularly from above downward, thence to spread uniformly

over the neck, chest, etc. 5. The superficial vesicles of variola contain only *serum;* the deeper-seated vesicles of variola, serum and, later, *pus.* 6. The eruption of variola is much more *uniform* in size; that of varicella varies greatly. 7. Varicella is rarely confluent anywhere, and its vesicles are only *exceptionally umbilicated.* By the end of the third day spots of hyperæmia, fully developed vesicles, and crusts may be perceived simultaneously and side by side in varicella, whereas the *variations* in the age of the eruption would be observed only at *points distant from each other* in variola. 8. The eruption of varicella may be *abundant anywhere* over the body, the face, trunk, or extremities; the eruption of variola is most *abundant upon the face and fingers.* A thick eruption upon the fingers has often established the presence of variola. 9. *Fever precedes* by several days the eruption of variola, to fall with its appearance; whereas *fever* occurs only *with the eruption* of varicella, to increase with its development. Variola shows in further course marked secondary fever, absent in varicella.

There are exceptions to all these rules, but they form in their ensemble almost unimpeachable evidence. The cases about which may still hover any doubt or uncertainty should be considered as variola to secure proper protection of others by vaccination.

Prophylaxis and Treatment.—The mortality of varicella is practically *nil.* Trousseau says no physician has ever seen a patient die of chicken-pox alone; yet, inasmuch as complications, fatal hæmorrhages, catarrhal pneumonia (Meigs and Pepper), nephritis (Hutchinson and Henoch), have been recorded as coincidences or complications, delicate children may be protected by removal from the area of infection, or isolation of patients in separate rooms. Patients should remain indoors, if not in bed, during the existence of the eruption, and should not be permitted to return to school until all signs of it have disappeared. Vesicles, more especially extensive vesicles or pustules on exposed surfaces, should be treated with consideration to prevent or limit subsequent lesions. It is advisable to touch the surface of such vesicles with equal parts of carbolic acid and glycerin, to secure, if possible, speedy coagulation of their contents and destruction of pus-producing micro-organisms. Where the eruption is unusually abundant, as on the face, the whole surface may be bathed in sublimate solutions 1 : 1000–5000, or washed with one-per-cent solutions of creolin.

Other treatment is superfluous, or does not differ, if called for by complications, from that discussed with varioloid.

DIPHTHERIA.

Diphtheria (*διφθέρα*, leather, membrane), term diphtheritis first

applied by Bretonneau (1821); angina maligna; German, *Bräune*, from *pruna*, glowing coal; Spanish, *garrotillo*.—A grave, acute infection of the exposed mucosæ, especially the fauces, pharynx, larynx, nose, exceptionally the vulva, vagina, uterus, palpebræ, prepuce, anus, occasionally of any wound of the skin; characterized by the formation upon and in the tissues of the affected surface of a grayish-white membrane, tumefaction and pain in the throat, dysphagia, enlargement of the lymphatic glands, general prostration, comparatively short though indefinite duration; complicated often with septic infection; and followed at times by a paralysis peculiar to this disease. Diphtheria of the throat, which is alone discussed here, has a mortality equal to that of scarlet fever, measles, and typhoid fever combined.

History.—The history of diphtheria is involved in inextricable confusion, from the fact that all kinds of sore throat, simple and malignant, catarrhal and croupous, gangrenous, individual and epidemic, were differently styled by different authors up to the time of Bretonneau, who succeeded in disentangling diphtheria proper as a disease distinguished by the formation of a false membrane in the throat. That the ancient writers were familiar with the affection is recognized in a passage from Aretæus, who speaks of ulcers covered with a *quodam concreto humore albo*.

Disregarding now the frequent allusions made to the anginas by the early writers, because always confounded with secondary or other affections, we read the first clear and certain account of the disease as it prevailed under the name *garrotillo*, in Seville, in 1583, to extend throughout Spain in 1583–1618, the year 1613 being characterized, from the frightful mortality, as the "anno de los garrotillos." The disease appears next unmistakably in Italy in 1610, while Portugal was visited but slightly in 1626. The first definite account of it in Holland and France occurs in 1745, in England in 1748, in Switzerland and Germany in 1752; and in our own country, in New York in 1771, in our northern colonies in 1755, in Virginia in 1799. Diphtheria now nearly disappears from medical history from 1810 to 1840, with the exception of France, where it again showed itself in Lyons in 1810 and in Tours in 1818 to 1821, to fall under the observation of the eccentric but always original Bretonneau, who dissociated it, as stated, from other affections of the throat and distinguished it as a special disease. Bretonneau stoutly maintained that it was always a local process at first, with subsequent general infection. Later, in 1825, he recommended alum in its treatment, made tracheotomy in grave cases of invasion of the larynx, and invented the double canula for this purpose. Trousseau, the pupil of Bretonneau, declared: "In diphtheria it is as in malignant pustule, in which malady, by making

a direct attack upon the local affection, we stop the progress of the general disease. . . . So also it is in diphtheria: by energetically treating the local affection as soon as it shows itself, we arrest its progress and prevent the occurrence of ulterior symptoms."

The new era of general dissemination or pandemic occurrence dates, according to Hirsch, from 1857–58, when the disease appeared in, or was carried to, remote parts of the earth, as India, China, Australia, Polynesia, Africa. It showed itself almost simultaneously in California and New York in 1856, next in the Eastern States, then in the Middle, Southern, and Western States, reaching Oregon in 1867. Our first accounts of it date from Mexico in 1864; Newfoundland in 1867; South Russia in 1872 to 1879, when it raged in villages to such extent that Kupffer says "the children disappeared."

Etiology.—Neither season, soil, nor social caste is directly concerned in the production or the spread of true diphtheria. The disease prevails in the most salubrious villages at times, sparing the marsh, passes the crowded tenements of the city to visit the palaces of the suburb, and shows itself at every season of the year.

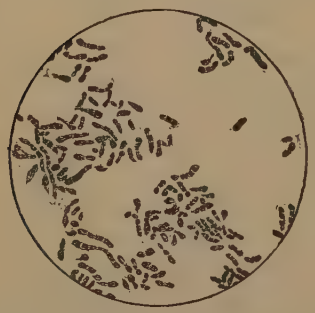


FIG. 139.—Bacillus diphtheriæ from blood serum (Sternberg).

False membrane may be formed in the throat by various micro-organisms, especially by the Streptococcus pyogenes, but the true diphtheria is produced by a special bacillus discovered by Löffler in 1883. Klebs had previously seen the same structure among others in the false membrane of this disease, and had recognized it as one among other causes of the disease, so that the micro-organism is now known as the Klebs-Löffler bacillus. To Löffler is due the credit of having first isolated it and experimented with it upon lower animals.

Bacteriology.—The Bacillus diphtheriæ is about as long but is twice as thick as that of tuberculosis. It is always rounded at both ends, and is frequently knobbed, to present the appearance of dumbbells, by which name it is commonly known. It is immobile, shows no spores, has its optimum temperature at body heat, and stains perfectly with alkaline methylene blue. It thrives in most of the culture soils, best in blood serum, lives desiccated over one hundred days, and produces, when injected into the bodies of certain animals, definite symptoms and speedy death. Thus it develops in guinea-pigs, rabbits, chickens, and pigeons, at the seat of inoculation, a pseudo-membrane, in which it rapidly multiplies.

Frosch declares that he found it in the blood, brain, lungs, liver, spleen, kidneys, cervical and bronchial glands in man, and Abbott claims to have demonstrated it in the omentum after inoculation of the testicle of lower animals. Most of these animals succumb within a few days after its introduction into the tissues. Injected into the trachea of these animals, or engrafted upon a scratched conjunctiva or vagina, it develops the pseudo-membrane found in human croup. Paralysis follows in certain cases.

Culture soils, filtered free of bacilli, produce, when injected, the same effect as soil containing bacilli (Kitasato). Diphtheria is therefore a local infection, by a bacillus whose toxalbumin produces the general effects (Welch and Abbott). This toxalbumin is very sensitive to heat. It perishes in a few minutes at 65 C.° All observers encountered also other bacteria, especially strepto- and staphylococci, which penetrate the depths of the tissues and induce general infection. Thus develop varieties—mild, or secondary, or malignant, or gangrenous diphtherias. Cultures distinguish the various bacteria and establish the diagnosis in a doubtful case (Baginsky).

Animals may be rendered immune to diphtheria by previous treatment with the peroxide of hydrogen; by inoculation with cultures subjected to heat, with the trichloride of iodine, with certain products of the bacillus itself, or with the fluid of pleural effusions which always form in inoculated guinea-pigs.

Fig. 140.—Streptococcus and staphylococcus from exudate.

Symptoms.—After a period of incubation of three to five days an average typical case of diphtheria begins with a *chill*, or chilly sensations, attended with *malaise*, *rise of temperature*, more or less nervous unrest, and, in the course of the same day, *distress in the throat*. In lighter cases throat symptoms may alone direct attention to the character of the disease, while in more pronounced cases the general distress assumes such prominence that the practitioner is led to look into the throat only because he may find for it no adequate explanation elsewhere. Thus it may happen that the disease is not recognized until the third or fourth day, by which period valuable time for therapy is lost.

It is characteristic of diphtheria to show objective signs in the throat very early in the history of the disease. Along with the complaints of *dryness*, *burning* and *constriction*, evident *dysphagia* and tenderness, there may be merely a more or less pronounced hyperæmia about the tonsils, veil of the palate, or pharyngeal wall, to constitute the so-called catarrhal stage, in which the false membrane may be entirely absent. Such cases are readily mistaken for a

simple catarrh, tonsillitis, or quinsy until complications or sequelæ betray the true character of the disease.

For the most part, however, there is little room for mistake. The *false membrane* shows itself early as flakes, spots, or streaks, not easily distinguished from pure mucus, upon the mucous surface ; white, filmy, or fleecy, easily detachable at first with the finger or handle of the spoon, to become in the course of a few days thicker, tougher, and darker in color, and to involve the mucous coat to such extent as to leave a raw, bleeding surface after forcible removal. The false membrane may remain localized, or may spread gradually or rapidly over the whole interior of the throat, to extend thence to the nose, Eustachian tube, larynx and bronchi, œsophagus, or, being detached by cough or processes of sloughing, may renew itself in former sites to indefinitely prolong the disease.

Still later in the course of the disease, as a result of mixed infection, the membrane may grow darker, grayish-black or absolutely black, become more friable and be detached in places to hang in festoons, or be insufflated with acts of respiration to excite violent cough or interfere directly with respiration. The peculiar and fetid odor of decomposition is now usually present ; the face is pallid, the pulse feeble or easily excited, and blood poisoning is marked by apathy and profound adynamia.

With the extension of the disease deep into the tissues of the mucous membrane there is invasion of the submucous connective tissues, *lymph ducts and glands*, and interglandular connective tissue, so that individual glands, tender to pressure, may stand out prominently above the general surface of the neck, or the natural outlines of the neck be obliterated in a universal tumefaction.

As in all the grave infections, parenchymatous changes may occur in the heart, liver, spleen, and kidneys, so that *heart failures* in the course of the disease, peri- and endocarditis with subsequent valve lesions, *albuminuria* with subsequent Bright's disease, may attend the course, complicate the progress, or protract the convalescence, if they do not directly take life.

The *paralysis* which occurs during, or much more frequently after, diphtheria is, as stated, in its course and character peculiar to this disease. It shows itself in about one-fourth of all cases which do not succumb to the attack. Rare in infancy, liability to it increases with years. It occurs alike in the strong and feeble, in mild as well as in severe cases, in diphtheria of other mucosæ, or of wounds as well as of the throat. It has been observed in the throat as early as the second, more frequently at the fifth to the tenth day of the disease, but as a rule not until the second or third week after the disease has run its course. It is regarded, hence, as a post-diph-

theritic process, due in all probability to the delayed action of toxines upon peripheral nervous organs. Its mode of invasion and progress constitute peculiarities distinctive of diphtheritic paralysis. In the first place, it is ushered in at once without prodromata, usually in the midst of health, or that degree of it which is left in convalescence from the attack proper. With very few exceptions it shows itself first in the *palate*, in difficulty of deglutition, and often of phonation. Fluids regurgitate through the nose, and the voice is altered. On inspection it is seen that the palate drops or is not lifted in pronouncing "ah," or the uvula is deflected. Gargling is impossible. The paralysis may extend to involve also the epiglottis, which ceases then to protect the larynx during deglutition, or more rarely to the pharynx to increase the dysphagia. There is often also paralysis of sensation, so that the veil of the palate may be manipulated without reflex action, or the pharynx may form a pouch in which food accumulates.

The paralysis next affects the intrinsic muscles of the *eye*. Far sight remains, but accommodation for near objects, as in reading, is decidedly interfered with. Yet the light reflex persists unaffected. Here the paralysis may cease, or in about one-half of cases the *extremities*, the lower first, are affected with tingling, numbness, formication. More frequently motion alone is impaired, the legs are weak, there is early fatigue with a sense of heaviness or weight, the patient staggers occasionally or constantly, the gait limps. As in the throat and eye, the affection is usually bilateral, though one side may suffer sooner or more. Electric action, unimpaired at first, becomes feeble or absent to faradization. Knee jerk is always diminished, then lost, from and even before any sign of paralysis proper—a phenomenon of very great diagnostic significance, and "part of a wider fact that the knee jerk is often lost after diphtheria (two-thirds of cases) in which no paralysis occurs" (Bernhardt). Paralysis of the intercostal muscles, diaphragm, and heart is fortunately very much more rare. Dyspnœa, vertigo, heart failures, with retarded, irregular, and intermittent pulse and fatal syncope, result from attack of these muscles. Impotence from affection of the sexual centres is not quite so rare in adult males. The bladder and rectum are very rarely involved. It is in this order that diphtheritic paralysis shows itself as a rule, though the natural sequence is often disturbed and "irregular waves of palsy seem to flow through the body" (Gowers).

Still another peculiarity of diphtheritic paralysis is its incompleteness. The paralysis is rarely absolute. It is, as a rule, more a weakness than a total loss of power. It is regarded as a polyneuritis and not as a central lesion.

Diagnosis.—The points upon which the diagnosis of diphtheria rests are: 1. The prevalence of the disease. 2. The absence of a previous attack; for the belief gains ground, contrary to previous opinion, that one attack secures future, at least temporary, immunity. Thoresen claims that in six hundred patients he never knew a second attack. He had the hardihood to quarter diphtheria patients in houses where children had suffered previously, and never saw a second attack. Contrary opinion is due to confusion with follicular angina. 3. Affection of both tonsils, with extension to the palate, etc. 4. Albuminuria. 5. Discharge of a thin, serous fluid from, or presence of false membrane in, the nose. 6. Contagiousness. 7. The bacillus, which is easiest cultivated to colonies (twenty-four hours) upon cooked white of egg. Tumefaction, lymphadenitis, and fever are not essential; typical cases may show none of these signs.

Diphtheria is distinguished from simple *tonsillitis* by its attack of others (en- or epidemic), false membrane, lymphadenitis, and general tumefaction, not present in tonsillitis; by the more profound prostration, adynamia, loss of knee jerk, and subsequent paralysis in diphtheria; from *quinsy*, which is epidemic tonsillitis, by the more pronounced inflammation and acute distress, greater swelling and dysphagia, with at times œdema of the uvula, palate, and glottis, absence of false membrane, presence of knee jerk, and, notwithstanding the severity of the symptoms, more favorable course of quinsy.

That a *scarlatinal* differs from true diphtheria is now determined by the researches of bacteriology. Clinically the affections differ as follows: The false membrane appears at once in diphtheria, later in the course, three to five days, of scarlatina; it shows itself in nearly all cases of diphtheria, but only in severe cases of scarlatina—viz., such as are marked by high fever, delirium, etc., at the start; it shows a preference, after the pharynx, for the larynx in diphtheria, and for the upper respiratory passages in scarlatina. In connection with it suppuration of the cervical glands and affections of the ear are frequent in scarlatina, rare in diphtheria. The interglandular connective tissue is indurated in scarlatina and only œdematous in diphtheria. Paralysis, which is frequent in or after diphtheria, is almost unknown in scarlatina. On the other hand, nephritis, a frequent sequel of scarlatina, is very rare after diphtheria. Lastly, treatment has much less effect upon the membrane of scarlatina. Hence it is proposed by clinicians (Henock, Filatow) to abandon the use of the term diphtheritic in scarlet fever, and to designate such cases as malignant scarlatinal anginas.

The *prognosis* of diphtheria is always grave on account of liability to heart failure, to sepsis (from mixed infection), and to extension to the larynx (croup). All these dangers are lessened or prevented by jugulation of the disease by energetic local treatment at the start.

Statistics, which date from the time when the disease was believed to be constitutional with a local expression, are valueless in determination of its gravity. Practitioners, thoroughly convinced of the local origin of diphtheria, do not fear it as they do scarlatina. It must be stated, however, that the amount or extent of the false membrane is no gauge of the gravity of the disease. Cases with throats covered as if with a layer of thick white paint often run a mild, short course, while the gravest symptoms—adynamia, heart failure, syncope—may occur in cases in which the membrane is so scant as to embarrass diagnosis. The character of the cause, whether the Löffler bacillus or the streptococcus, may make the difference. The gravity of the disease is rather a question of absorption than deposit, and the danger is determined by the penetrability of the barrier which the tissues interpose. This is a condition which may not be discovered by simple inspection. It reveals itself only in its effects. Profound adynamia, a feeble pulse, *mixed infection*, extension into the nose where it cannot be reached, suppuration, gangrene, make the prognosis very grave. The paralyses of diphtheria generally subside spontaneously in from three weeks to three months, and may be much abridged with appropriate treatment.

Prophylaxis consists in isolation of the patient, thorough ventilation of the sick-room, and utmost cleanliness. The weaker antimycotic gargles mentioned in treatment may be used by others in the house. A child should not return to school for forty days.

Treatment.—From what has been stated it is obvious that the true treatment of diphtheria must secure or attempt the eradication of the membrane which contains the germs of the disease. This treatment must be introduced at once, or so soon as the diagnosis is made. A dubious diagnosis justifies it, inasmuch as under no circumstances can it do harm. What particular agent is employed is probably a matter of indifference, so that it be powerful enough to accomplish the object. Bretonneau used fuming hydrochloric acid. Carbolic acid, corrosive sublimate, creosote, and creolin each have their advocates. The author prefers above every other agent the subsulphate of iron, as it not only destroys all micro-organisms which it may reach, but by its powerful astringent action interposes a barrier between them or their products and the blood, and thus prevents the absorption which produces the so-called constitutional signs. The subsulphate is preferable to the tersulphate, on account of its greater astringency; and to the perchloride, which is much more astringent because it is much less irritant.

The remedy is applied best by means of a cotton-wrapped sound, the end of which is immersed in the undiluted solution and pressed on withdrawal against the neck of the bottle, that the fluid may not

drop into the larynx, and the false membrane is touched or the surface painted, under a good light, with the deftness and dexterity of an artist in touching a canvas. One application a day will suffice in an average, two in an aggravated case. It is generally well borne, exciting but little cough and expectoration, both of which are, however, favorable for the dislodgment of the membrane. Retching and vomiting sometimes follow—processes which also facilitate the discharge of the membrane and stimulate the patient out of the apathy and adynamia characteristic of grave cases.

Inhalations of steam from a steam atomizer, as hot as can be borne, are also of great value, if practised repeatedly throughout the day and night. They accomplish more in the dissolution of membrane and disinfection of the throat than any chemical solvents, lime water, lactic acid, pepsin, papayotin, etc., and the various disinfecting gargles, etc., all of which are useless unless inhaled or applied more or less continuously, which is almost impracticable. The insufflation of yellow oxide ointment gr. v.–3 ss. vaseline into the nose, two or three times a day, keeps the nasal passages moist and free, and adds much to the comfort of the patient. Sprays of fresh, pure peroxide of hydrogen are more efficacious in this regard than any other agents. Löffler recommended very deep gargling with sublimate solution 1 : 1,000, or carbolic acid three per cent dissolved in alcohol thirty per cent, or carbol five per cent, or bromine two per cent, or chlorine one per cent solutions. In the first stage of the disease, when the membrane is very thin, or in prophylaxis, Löffler prefers weaker solutions, as of sublimate 1 : 10,000 or 15,000, or, for its more agreeable taste, the cyanide 1 : 8,000–10,000, with introduction into the nose of toluol, which will diffuse itself throughout the nasal tract.

The general symptoms are best met with alcohol, which, in its direct effects upon the heart as a cardiac stimulant, best obviates the danger of heart failure. Digitalis, preferably in infusion, ʒ i.–ʒ ss. every two to four hours, may become a necessity in protracted cases. Nitroglycerin acts quickly and does not at all irritate the stomach. A cup of strong, black coffee, with a tea- to a tablespoonful of cognac, is a quick though more temporary restorative. Subcutaneous injections of alcohol, ether, camphor, musk, may be necessary to bridge a case over an impending or actual collapse. In most cases a bold local treatment, by putting a stop to further infection, will often rescue a case from the profoundest prostration, and put a new and more favorable phase upon the disease in the course of a few hours.

Paralysis is best treated by faradization and nitrate of strychnia gr. $\frac{1}{100}$ subcutaneously.

CROUP.

Croup (old Scotch, *croops;* Danish, *hrop;* old Dutch, *hrof* and *geroef;* German, *Geruf*, cry, crow).—The crowing, stridulous sound of inspiration through an occluded glottis, as by spasm, false croup, laryngismus stridulus, or by false membrane, true croup, membranous croup.

True croup, in the majority of cases, is diphtheria of the larynx. What features of difference it may show depend upon its localization and the rapidity with which it ends life by suffocation. Croup is, therefore, a disease which adds to the dangers of diphtheria a mechanical obstacle to respiration. Croup may also exceptionally develop in connection with, or as a sequel to, other infections—measles, scarlatina, pertussis, rötheln, variola, typhoid fever, etc.—or in still more exceptional cases from mere catarrhal inflammation, or most exceptionally from chemical or mechanical irritation.

History.—Dyspnœa and dysphagia from throat disease were all included under the term *cynanche* (angina) by the old Greek writers, and laryngotomy (first by Asclepiades, 100 A.C.) was not infrequently resorted to in relief of suffocation. Galen certainly refers to a case of croup in an adolescent "qui tussicando tunicam crassam viscosamque exspuerat." Baillou, Paris (1576), describes cases secondary to measles and pertussis, and Van Hilden (1641), Ettmüller (1685), Patrick Blair (1718), who is credited with the first adoption of the popular word "croops" into medicine, mention cases under the term "catarrhus suffocativus," which included also all kinds of diseases of the pharynx and larynx. It is, however, to Francis Home, of Edinburgh (1765), that we are by universal consent indebted for the first distinct identification and isolation of true croup. Home published his conclusions, based upon a wide and keen observation, in a short tract of sixty pages entitled "An Inquiry into the Nature, Cause, and Cure of the Croup." Home looked upon the disease as primary in the larynx, and ascribed its symptoms to the presence of a membrane which he found in the trachea in all his post-mortem observations. Cheyne (1801), in an essay on "Cynanche Trachealis, or Croup," confirmed these views, which now prevailed undisturbed up to the time of Bretonneau (1821), who first advocated the identity of croup with diphtheria.

Etiology.—Croup occurs occasionally also as a complication, sometimes a fatal complication, of measles. It is more rarely seen in the course of, or as a sequel to, scarlatina; still more rarely after typhoid fever. Croup may occur entirely independent of any infectious disease. Bretonneau himself recognized the possibility of the production of croup by the application of irritants, as by cantharides.

Oertel, Trendelenberg, Schwenninger were able to produce false membrane in animals by various mechanical and chemical irritants. It has long been known that false membrane may be formed in the larynx in consequence of the inhalation of hot steam. Heubner produced false membrane in the larynx by interruptions of the circulation. Most interesting are the observations of Kreissig, who saw false membrane formed in the larynx of animals subjected to high temperature. Heat and dryness are at times sufficient causes for the formation of false membrane. Inhalation of irritant gases—ammonia, chlorine, bromine, fuming mineral acids—will also produce false membrane in the throat.

These constitute the cases of so-called primary croup. It is undeniable that such cases do occur. They constitute, however, the small minority of cases of croup. In these cases the cause is demonstrable, and the lesion of tissue or false membrane which forms distinguishes itself by remaining circumscribed. These are the cases in which the disease remains more strictly confined to the larynx. They differ, therefore, radically from the cases produced by infectious matter, whose nature it is to spread. It remains, therefore, true that croup, in the vast majority of cases, is diphtheria of the larynx.

The disease attacks by preference children between the ages of two and seven. Cases of attack in infancy, as by Bouchut at the age of eight days, Monti fourteen days, are very great exceptions. Liability begins to diminish at five and becomes almost annulled at seven. Exceptionally cases have been reported even late in life. Diphtheritic croup does not remain confined to the larynx, as a rule, but extends in most cases to involve the trachea and bronchial tubes. Steinert saw four cases of croup ascend from the trachea to the larynx; and of fifty-five cases, five only were confined to the larynx, nineteen involved also the trachea, and thirty-one extended to the bronchial tubes. In the epidemic at Königsberg, Bohn found in twenty autopsies the trachea affected sixteen times, the bronchi only three times. Bretonneau in thirty-two cases found the bronchial tubes unaffected only once. In one hundred and forty-four autopsies after croup, Peter found in the bronchial tubes catarrh forty-four times, croup thirty-two times, in eleven no lesion at all.

Symptoms.—Croup sets in very insidiously, and may not be distinguished at the start from an ordinary catarrh localized in the larynx. There may or may not be more or less malaise, fretfulness, irritability, irritation about the throat, but in the course of a day or two the inflammation of the throat takes on that specific character which distinguishes itself by the alteration of the voice, the character of the cough, and the difficulty of breathing. *The voice becomes*

husky, the cough more guttural, the breathing more difficult. As a rule the child wakens in the night with the symptoms of marked croup. Probably at the very start the voice is lost. The child cannot speak above a whisper. It tosses about the bed, exhausted, agitated, moves its head about first on one side, then on the other, seeking by change of posture to obtain relief. The breath is longer drawn, occasionally sighing; the auxiliary muscles of respiration are called into play. The mouth is open; there is play of the nostrils, evident straining to force a full breath. Under all these efforts, in the course of time, the breathing becomes somewhat easier. The child, exhausted, sinks to sleep, to be awakened often in the course of the night with a repetition of the same scene. The patient is no, or but little, better in the morning. There are more or less distinct remissions, but there is no real relief. The attack repeats itself several times during the day, and by the following night becomes distinctly intensified. The child is now wholly unable to sleep. The efforts at breathing become more strained and more painful to see. The face is flushed, the eyes glisten with a wild anxiety. The child clutches its throat, as if to tear an opening into the larynx, seizes the bedclothes, frantically tears the paper from the wall, shows mania, and finally sinks back exhausted, sometimes actually to suffocate in the attack, oftener to secure a comparative rest after the final entrance of a small quantity of air. Soon now ensues the stage of *carbonic-acid poisoning.* The face becomes pallid, cold, and blue, the surface is covered with a clammy sweat, the hot maniacal struggle ceases, the spirit is broken, the child lies apathetic, seemingly indifferent. Respiration is more shallow and superficial. The intercostal spaces, the jugulum, epigastrium, supraclavicular regions, no longer retract or sink in with each act of inspiration. Sopor sets in, which deepens into stupor, coma, death. But in a minority of cases, at the height of the stage of struggle, quantities of false membrane may be ejected, casts of the larynx or the trachea, or even of the bronchial tubes, with such temporary relief at times as to give rise to the illusory belief in recovery. The membrane forms again, however, in the course of a few hours. An entire cast may reform in five or seven hours, to renew the same picture of distress.

As a rule not much is to be seen in the throat—hyperæmia, swelling, occasional flakes or films or masses of false membrane about the fauces or glottis, or in the larynx itself. What is especially to be remarked in the larynx is the swelling and occlusion of its orifice. Pieniazek finds the cause of the dyspnœa to be not so much the deposit of false membrane as the fixation of the vocal cords or bands by reason of the exudation of intense inflammation. The arytenoid cartilages lose their play of motion, becoming, as it were, solid, an-

chylotic. Hence the dyspnœa; hence also the character of the cough and the alteration of the voice.

Duration.—Croup is sometimes divided into stages of catarrh, stenosis, and collapse. The first stage lasts from one to ten, on the average three, days; the second one-half to seven, on the average three, days; the third one-half to two, on the average one, day. Thus the disease may run its whole course in two days, or protract itself over two weeks, but most cases scarcely occupy more than one week.

Diagnosis.—Croup is diagnosticated by the catarrh of the larynx; by the laryngismus and loss of voice; by the peculiar character of the cough (Trousseau likens it, happily, to the sound of the bark of a puppy dog at a distance); by the dyspnœa with its long-drawn, audible, stridulous inspiration; by the play of the auxiliary muscles of respiration; by the retractions of the intercostal spaces; and by the false membrane.

True must be separated from *false croup*, laryngismus stridulus, which attacks for the most part infants brought up in close, hot, ill-ventilated apartments, hence children of the wealthy, coddled, pampered, over-protected rich oftener than the children of the more exposed poor. False croup may rest at times also upon a light catarrh. The child goes to bed, however, comparatively well, and is awakened suddenly in the night with the same terrible struggle for air. It shows the same distress as true croup, even more intense at the start, but subsides more quickly and completely, with, if it is to recur, much more distinct intermissions, and yields readily to simple treatment. It occurs again and again in the history of the child, whereas true croup occurs but once. There is, of course, no membrane in false croup.

Œdema of the glottis occurs, in the great majority of cases, in adolescence or maturity, and in the course of laryngitis or some outside disease, as of the heart or kidney. It is often associated with œdema, visible œdema, of the palate and fauces. The uvula itself is often affected. The condition may be seen at times with the naked eye, and felt frequently with the finger.

Retropharyngeal abscess occurs, in a great majority of cases, in children in early infancy. It develops more insidiously than croup, and reveals itself sometimes to inspection, more frequently to palpation, as a soft, fluctuating tumor on the posterior pharyngeal wall. Abscesses, after infancy, occur next most frequently in youth, in consequence of caries of the spine, with the history of exposure to infection by tuberculosis or with evident depots elsewhere.

The *prognosis* of croup is intensely grave. The child succumbs for the most part to direct suffocation, carbonic-acid poisoning, as-

phyxiation, or, surviving this danger, perishes later from blood poisoning in consequence of absorption, as in other cases of diphtheria. Operations for the relief of stenosis have, however, considerably ameliorated the mortality statistics. Cases left to themselves have a mortality, as a rule, of sixty to seventy per cent. Recoveries are the exceptions. Death is the rule.

Treatment.—Internal medication has over the false membrane of croup no control. Emetics may dislodge loose fragments, or more especially relax spasm to give temporary relief, but for the most part they add their own depression to that of the disease and are not to be recommended. Where for any reason they may be administered, selection should be made of the milder drugs, as of the subsulphate of mercury gr. iij.–v., or ipecac gr. xv., or apomorphia gr. $\frac{1}{12}$, which has the double advantage that it does not depress and may be administered subcutaneously. These are emetics and expectorants to be selected, but in no case to be continuously administered. Local applications, gargles, etc., are useless, because they may not reach the disease, or under any circumstances remain longer than a few seconds in contact with it.

Benefit is always to be derived from the inhalation of steam, which may be conveyed to the bed under a tent improvised from the bedclothing, from a kettle on the fire, or, better, by means of a steam atomizer, to which additional solvent properties may be given by the use of bicarbonate of soda, lime water, lactic acid, etc. Papayotin may be applied in solution with a brush. Nothing radical may, however, be expected of any such treatment. Nor may drugs furnish any substantial relief until they may be applied in concentrated form to the interior of the larynx itself after tracheotomy. The application of carbolic acid, corrosive sublimate, solution of the subsulphate of iron, directed to the interior of the larynx after laying it open, is a question of the near future. At the present time the only relief to be expected in a case of croup comes from surgery. The obstacle in the throat is to be overcome either by intubation or tracheotomy. Intubation is a simple operation, which proves effectual in nearly forty per cent of all cases; most effectual, of course, in cases more circumscribed or more strictly confined to the larynx. The operation requires but little practice or skill, and does no harm should it fail to do any good. Moreover, it in no way interferes with the more radical operation of tracheotomy. Tracheotomy itself has been recently much simplified. It is an operation *per se* devoid of danger. It is performed now for the most part bloodlessly. Tracheotomy rescues about thirty-five per cent of all cases, thirteen per cent of diphtheritic, and sixty per cent of non-diphtheritic croup —a percentage which would be increased if the operation could be

done as soon as the first signs of stenosis set in. Both operations have saved children who have actually ceased to breathe, so that it is never too late to try either or both.

QUINSY.

Quinsy is an anglicization of the Greek *cynanche;* Latin, *angina* (sore throat); limited in our day to epidemic tonsillitis. It is an acute, probably contagious infection of the fauces, pharynx, and tonsils.

Etiology.—The disease prevails most frequently during the seasons of fall and winter. It spares the extremes of life, to show itself between the ages of fifteen and thirty. There is a marked difference in different people in susceptibility to this affection, in that certain individuals suffer repeated attacks. Yet a single sharp attack confers immunity for at least a year.

Symptoms.—Quinsy distinguishes itself by the severity of its symptoms, which are out of all proportion to the gravity of the disease. It announces itself after an indefinite and unestablished period of incubation, with more or less sharp *chill*, attended by *fever*, anorexia, at times even nausea, *pain in the back and limbs*, headache, and pretty profound prostration. *Gastric distress* is more or less pronounced. There is a heavy coat upon the tongue, at times distinct nausea, and in younger individuals occasionally vomiting. The fever is high; the temperature advances, on an average, to 103°, and it may run up to 105° at the onset or at any time in the course of the disease. It is plain to see that an individual affected with quinsy is a sick man. The local manifestations are pronounced. The patient complains at once of a *sore throat*, which shows itself also in difficulty of deglutition. The veil of the palate, the uvula, both tonsils, the wall of the pharynx, are markedly hyperæmic and swollen. The tonsils project as globular, shining masses into the throat, to such an extent often as to touch, sometimes to make such contact as to be flattened by mutual compression. Deglutition has now become not only difficult but painful, and in extreme cases well-nigh impossible. Drinks or fluid food may regurgitate through the nose. Coughing and strangling efforts attend the ingestion of food. The patient finds no rest in a recumbent posture. He sits up in bed or out of bed, nursing his head in his hands, or walks about the floor, a picture of suffering and distress. By this time the tonsils have assumed such magnitude as to be manifest on the outside of the neck, visibly or palpably. Any pressure upon them elicits or aggravates pain.

Quinsy is naturally a suppurative disease. It was known formerly as angina phlegmonosa. Sendtner found in a case the Strep-

tococcus pyogenes, which could not be distinguished from that of common pus. It becomes, therefore, a necessity to recognize the presence of pus and evacuate it as soon as possible. The protruding point of suppuration may at times be seen as a grayish-white discoloration of the surface, more often felt in posterior and inferior portions of the tonsillar mass. If the finger be passed over the surface of the tonsil and swept around its circumference, while pressure from the outside pushes it into the throat, the point of tenderness may be elicited, or, indeed, fluctuation felt. Masses of this magnitude block the Eustachian tube to produce more or less deafness, and occlude the nares to interrupt respiration and alter the voice, stop the pharynx to cause more or less profound dysphagia. There is also the possibility that rupture of the abscess in the tonsil may inundate the larynx. Fatal cases of this occurrence at night have been reported. In the natural course of events the abscess ruptures itself, to the indescribable relief of the patient. Quite frequently the disease stops short of suppuration, to undergo favorable resolution. The physician evacuates the pus, so soon as discovered, by a simple plunge of the bistoury, taking care to keep the knife parallel with the sides of the throat, or, if he finds it necessary to make a longer incision, to cut from without inward, that he may avoid the carotid artery. Outside pressure will help to fix the tonsil in the desired position to secure proper penetration by the knife.

The *prognosis* is not grave, notwithstanding the apparent severity of the disease. Patients recover entirely, sometimes, however, with hypertrophied tonsils, which, in fact, most of these patients will have had before the attack. There are no means by which quinsy may be cut short, and still less prevented.

Treatment consists in the application of moist heat—hot-water bandages, soft, hot poultices, hot-water gargles, inhalations of steam, whose efficacy may be increased by the addition of carbonate of soda—and especially in the speedy recognition and early evacuation of the abscess. Scarification and incision are not only useless but dangerous before suppuration. Sometimes the presence of pus may be recognized by means of a subcutaneous syringe—a safe and innocent procedure. Evacuation of the abscess ends the case. The salicylates, especially salipyrin, with Dover's powder, control any fever, light sepsis, or pain.

THE TYPHUS FEVERS.

Hippocrates used the term typhus (τῦφος, smoke) to describe a benumbed condition of the sensorium, as if produced by a cloud about the brain ; and the term was used for ages to indicate this intellectual obscurity, without reference to the name or character of

the disease in which it occurred. So, meaning nothing more definite, it fell into complete disuse until the time of Sauvages (1760), who revived it with special application to particular forms, which we now recognize more distinctly as three varieties of typhus fever—first, the oldest, *typhus* fever; second, a form separated in the fourth decade of the present century, *typhoid—i.e.*, like typhus fever; and the third, isolated distinctly by Obermeier in 1873 as typhus recurrens, or *relapsing* fever. All these forms were formerly inextricably confounded, and the graver varieties were studied under the common terms of spotted fever, fleck-typhus, hospital, ship, and jail fever, hunger typhus, etc., as indicating a disease produced by crowd-poisoning and following upon the heels of famine and want. Starvation, crowd-poisoning, filth, bad hygiene, these were the factors supposed to produce typhus fever spontaneously—factors now recognized as important elements in the spread, but not in the development, of the disease.

True Typhus, Typhus Exanthematicus.—Typhus fever prevails still in countries which represent the presanatory period of civilization, raging with great virulence in Ireland and Russia, and occurring, only in much more modified form, at longer intervals, in seaport towns of our own country. Congregations of men in armies and upon pilgrimages have often since disseminated typhus fever. It causes, in fact, or has caused, more death in military life than all the battles and perhaps all other diseases put together. Typhus fever was one of the plagues of old times.

History.—Typhus fever made its first appearance in our country in 1812 in New England, at which time it spread over the New England States, to thereupon disappear, and reappear only in 1836, on which occasion it visited Philadelphia in great virulence. Here, fortunately, it fell under the observation of Gerhard, who drew the first distinctive lines between typhus and typhoid fever. As these points were subsequently presented to the profession, more especially by Jenner, of London, they soon obtained general recognition. A few cases have been imported since from time to time, last in 1892 with one hundred and eighty-five cases, fifteen deaths. The disease has not spread beyond our seaport towns.

Etiology.—Typhus fever is pre-eminently a contagious disease, its infectious matter radiating from every surface and secretion. Susceptibility is almost, if not quite, universal, as the disease is exquisitely diffusible. The child of seven days, the old man of seventy years, are alike attacked. The poison may also be conveyed by third persons and by things. Physicians and nurses in direct contact with patients in hospitals fall frequent victims to this disease. The exact cause of the infection has not as yet been isolated.

Opportunity for study in centres where the etiology of the disease is most diligently investigated has not occurred in recent times. Lewaschew, of Kasan, finds a peculiar spirillum, endowed with active motion, in the blood of the spleen, less constantly in blood from the finger, which he was able to cultivate apart; and Cheeseman found in the blood of six patients a short, thick bacillus which he could cultivate upon agar and ox-blood serum, and which showed pathogenic properties, but not typhus fever, in rabbits, guinea-pigs, and mice. Typhus fever in its nature closely resembles a bad case of measles, in that the disease is so contagious, the liability is universal, in that the eruptions are much alike, and in that hæmorrhage may occur in either.

Symptoms.—The disease begins with a *chill*, or series of shivering fits, attended by *rise of temperature* to 103° to 104° or 105° in the course of twelve to twenty-four hours. The onset of the disease is *sudden*, often in the midst of perfect health. Exceptional cases show prodromata for two or three days in the way of malaise, depression, headache, pains in the loins and limbs. There is from the start profound prostration, and, with the very inception of the disease, overshadowing symptoms of *mental dulness, drowsiness*, sopor, deepening into stupor which readily passes over into coma. This is the cloud about the brain. In the first few days of the disease, and throughout the whole course of the malady, however light the case, the symptoms on the part of the nervous system are obtrusively distinct.

By the third day the *eruption* appears upon the body, over the chest, to extend thence over the entire body, but to spare always, or nearly always, the face. The eruption shows itself in the form of *maculæ*, crimson red, which soon become darker, and often coalesce, to give the body a *spotted* appearance, from which it derives a popular name. So the body is more or less equally studded with points of intense hyperæmia, maculæ, which may, as stated, coalesce and form larger surface ecchymoses or vibices, especially in debilitated cases or bad surroundings. A peculiarity in the eruption of typhus fever is the fact that by the third or fourth day these maculæ aggregate themselves into points of pinhead size filled with black blood—the so-called *petechiæ*. Another very distinct peculiarity is the fact that the *temperature does not fall with a full appearance of the eruption.* In most of the eruptive diseases the temperature at its height represents the period of efflorescence, after which all the symptoms, as a rule, decline and disappear. But in typhus fever the appearance of the eruption has no effect upon the temperature, which remains, with diurnal variations and accidental complications, much at the level at which it began, up to the twelfth

to the fifteenth day, whereupon it falls more or less suddenly, to reach the normal grade within twenty-four hours, to constitute the so-called decline by crisis. Figs. 141–145, from Moore on Fevers, show the temperature in typhus fever. The crises of the ancient writers, marked by profuse sweat and diuresis, were based, for the most part, upon observations of cases of typhus fever and pneumonia. The spleen is enlarged, as a rule, but not to the degree or with the uniformity that marks cases of typhoid fever.

All this time the symptoms on the part of the nervous system continue or increase. The patient is at first preoccupied, abstracted,

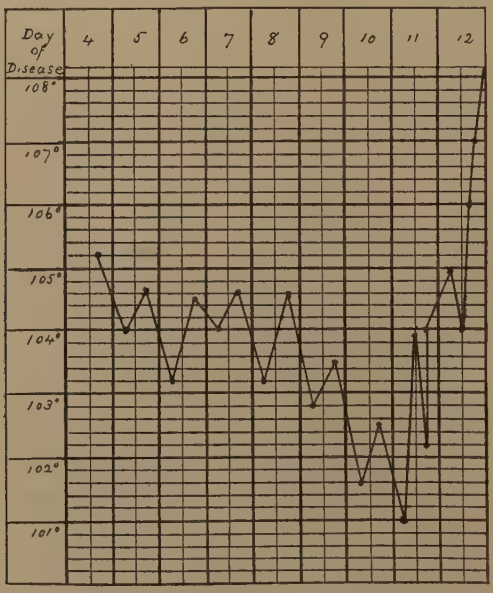


Fig. 141.—Temperature chart in adynamic petechial typhus fever.

pays little or no attention to his surroundings, lies in a state of sopor which lapses into stupor; responds at first to sharp address rationally, later irrelevantly, and later still not at all; lies in muttering delirium, slips down in bed like a leaden image, and may be pushed or pinched without a sign of feeling.

Parenchymatous change affects the muscles; the voluntary muscles, and more especially *the heart muscle, suffer degeneration.* This parenchymatous change is not the effect of the fever. Neither the delirium nor the degeneration is caused by the fever. They are both, with the fever, effects of a common cause. They do, as a rule, correspond. But cases of low fever may show great delirium. The converse is also true. Throughout the whole course of the disease

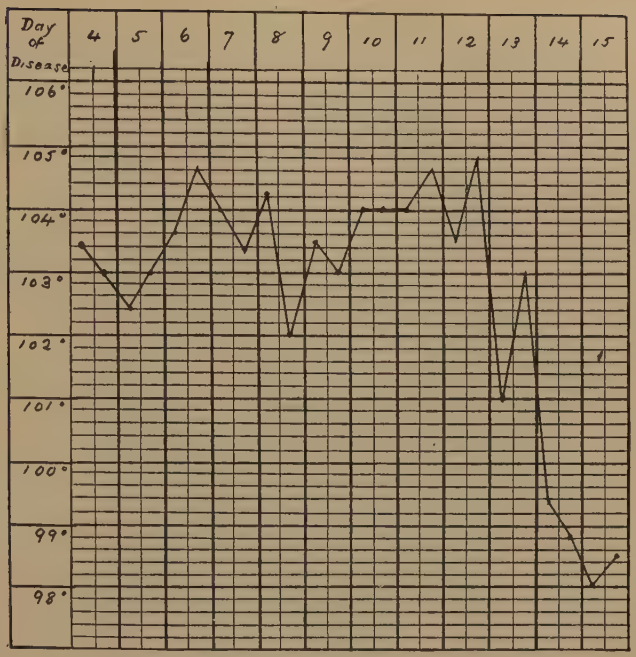


FIG. 142.—Temperature chart in ordinary typhus.

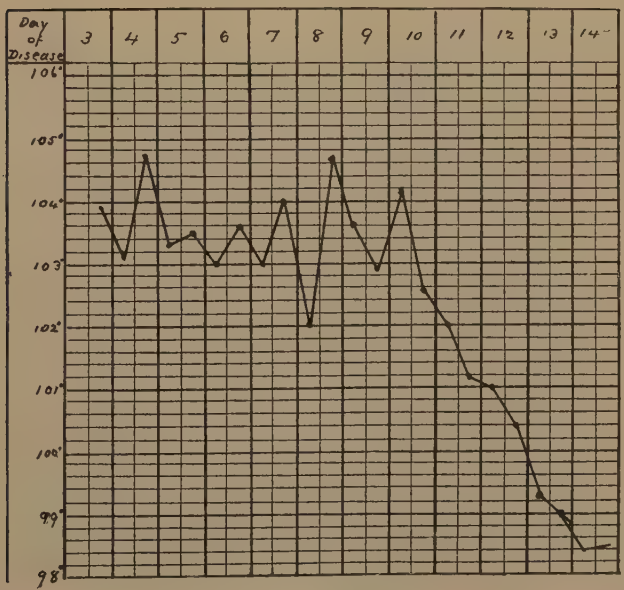


FIG. 143.—Temperature chart in typhus fever. Resolution by continuous lysis.

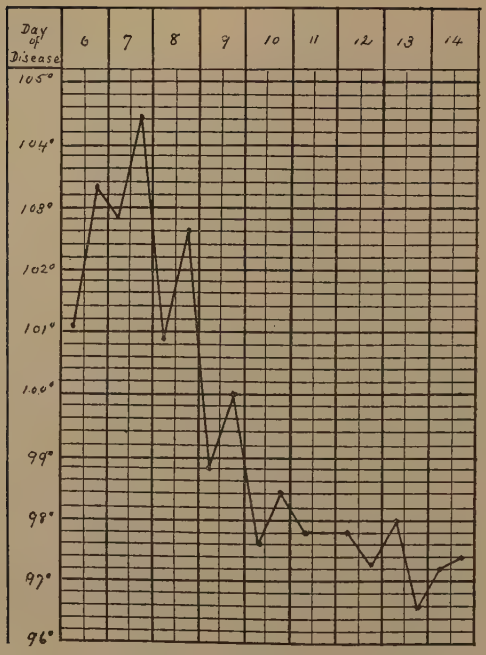


FIG 144.—Temperature chart in typhus fever. Resolution by crisis.

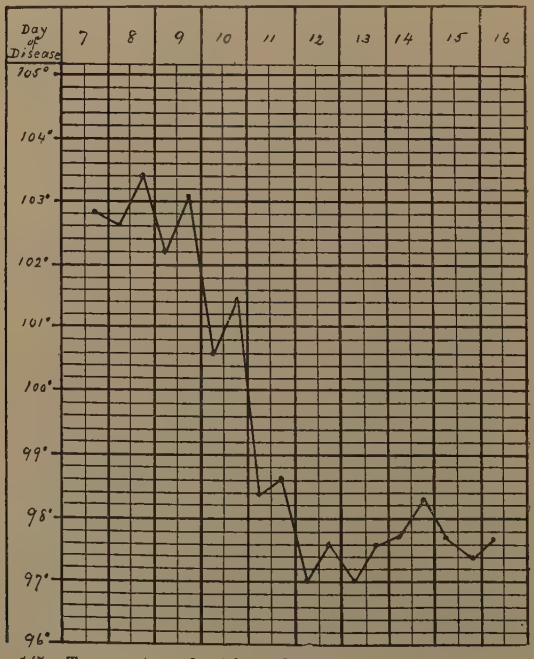


FIG. 145.—Temperature chart in typhus fever. Resolution by crisis.

there is great disturbance and distress on the part of the digestive system: the tongue is heavily coated, fuliginous; sordes accumulates about the teeth; later the tongue becomes dry, is fissured, and bleeds. By this time it may be no longer protruded from the mouth, or, if protruded under great effort, remains, and is not withdrawn until after repeated request.

There is from the start *anorexia*, *nausea*, frequently *vomiting*, which is at times excessively defiant of control. As in all the grave acute affections where the intestinal wall is itself not affected, the *bowels remain constipated* throughout.

The *diagnosis* is based first upon the existence of the disease in the land. In our country there is a history of direct importation and transportation to the individual case. Ireland, Russia, some parts of India, are the homes and haunts of typhus fever, and cases, to reach us, must follow the lines of travel. The disease begins *suddenly*, often without prodromata, and violently. The *eruption* appears on the *third day* as maculæ over the body, to become after three days petechial. *The eruption spares the face.* The appearance of the eruption is not attended with any fall of temperature. The symptoms on the part of the nervous system show themselves from the start, and prevail and predominate throughout the whole course of the disease. *Abdominal symptoms are wanting.* The fever falls on the twelfth to the fifteenth day, and the disease terminates by crisis.

Typhus is distinguished from *typhoid fever* by the sudden onset of typhus, or more protracted, insidious onset of typhoid. One attack of typhus secures but temporary exemption; one attack of typhoid confers immunity, as a rule, for the rest of life. The nervous symptoms show themselves in the incubative and prodromatous stage of typhoid, and but for a few days, if at all, before the outbreak of typhus. Typhoid fever is frequently announced by nose bleed, absent in typhus. It is the upper respiratory tract which is attacked in typhus, along with the rest of it. In typhoid fever the bronchial tubes only are involved. Thus there is bronchitis in both diseases, but there is also coryza in typhus fever, with irritation in the nose, sneezing, which almost never occurs in typhoid. Constipation is the rule throughout the whole course of typhus fever. There may be constipation during the first week in typhoid, but, as a rule, there is more or less diarrhœa from the start. The spleen is more distinctly and more constantly enlarged in typhoid fever. The eruption appears on the third day of typhus fever, more or less universally over the body. The eruption appears in typhoid fever on the chest about the seventh to the tenth day. It is much more scanty and much more distinctly isolated. Typhus fever often shows herpes on the face,

typhoid almost never. The duration of typhus fever is two, typhoid fever four weeks.

Typhus fever is distinguished from *measles*, which it more closely simulates, by the fact that typhus attacks all ages, measles chiefly children. This fact is not due to the greater liability to measles, but to the fact that measles prevails always, and typhus only at intervals. Measles is preceded for three days by coryza; typhus shows coryza at the onset of the disease proper. Measles has a period of invasion of three or four days; typhus begins at once. The eruption in typhus fever appears on the third day on the body; of measles on the fourth day on the face. The eruption of measles occurs in patches or individual spots in spreading over the body, including the face where it begins; the eruption of typhus is more universally distributed over the body, sparing the face. The eruption of measles remains macular and disappears by branny desquamation; the eruption of typhus becomes petechial and disappears by absorption without desquamation.

The *prognosis* of typhus fever is always grave, yet its gravity has been reduced in our period by sanitation, relief from crowd and sewage poison, to twenty per cent. The therapy of the disease is wholly symptomatic and will be discussed with that of typhoid fever.

REFURRENT FEVER.

Recurrent (relapsing) fever has been distinctly recognized in the history of the graver infections since the beginning of the eighteenth century, though its differentiation from other forms of typhus, more especially true typhus, is an acquisition, as stated, of very recent times. Recurrent fever has its home in Ireland and the east of Europe, whence it has been carried, often in epidemic proportions, to various parts of the earth.

Etiology.—Recurrent fever arises only from itself. It is rapidly disseminated in unsanitary conditions. It has in this regard the same history as true typhus. The disease is declared to be contagious. There is no individual immunity. Immunity is not conferred even by a single attack, which seems rather to predispose to other attacks. Recurrent fever is now known to be caused distinctly by the invasion of a special micro-organism, the spirillum or spirochetes of Obermeier (1873).

Bacteriology.—These spirilla, interesting as the first micro-organism actually seen in the blood or body of man, exist in the blood only during the period of fever. They disappear entirely from the blood of the dead body. They are long (16 to 40 μ), spiral threads, curled like a corkscrew, and endowed with active motion, both spiral

and undulatory. Though attempts at outside cultivation have not yet been successful, the introduction of blood containing the parasite conveys the disease to other animals (apes) and to man.

Pathology.—The changes in the body do not differ much from those of typhus. There is rather more predominating evidence of parenchymatous degeneration of the liver, and at times such distention of the spleen as to lead to rupture of its capsule. The disease is more fatal in the ape after exsection of the spleen. Thus antimycotic action is ascribed to the spleen. While the mesenteric glands are enlarged, the plaques of Peyer and solitary follicles remain unaffected. Hæmorrhages, petechiæ, etc., occur occasionally, and icterus so frequently as to sustain the view of "bilious typhoid." This is one of the diseases included under the old "bilious typhus."

The period of *incubation* is five to seven days. The disease begins generally with a sharp *chill*, rapidly rising fever, severe *pains in the joints*, with rapid *prostration* and *gastric distress*. *Icterus* occurs as early as the fourth day. *Enlargement of the spleen* may be soon detected. Mental distress and delirium may show themselves at once.

Fig. 146.—Spirilla of relapsing fever in the blood.

What distinguishes the disease in any doubtful case is the *disappearance* of all these symptoms, however severe, so soon as they reach their height. At the end of the first week, when the patient shows such prostration and grave symptoms as to excite intense solicitude, the symptoms all speedily subside, the temperature reaches its natural limits sometimes in the course of a few hours, and the patient seems to have perfectly recovered. Somewhere between the fourth and the fourteenth day *the same symptoms show themselves anew*. They may be equally severe in their recurrence, but are, as a rule, much shorter in their duration, lasting from two to four days, when the temperature again falls and the symptoms subside as before. In most cases this is the end of the disease. In exceptional cases the patient may experience a third or fourth relapse.

Diagnosis.—Relapsing distinguishes itself from *typhoid* fever by the suddenness of its onset, or violence of the pains in the bones, muscles, and joints, and the secondary and subordinate character of the brain symptoms. Hebetude and headache are not so marked in the course of relapsing fever. Enlargement of the spleen occurs

early and is equally marked, but symptoms on the part of the liver assume much greater prominence than in typhoid fever. There is usually more or less icterus. Herpes, which is almost never seen in typhoid, is not infrequent in relapsing fever. The diagnosis rests further upon the apparent termination of the disease at the end of the first week, and its recurrence once or twice. It really rests upon the discovery of the spirillum in the blood. Examination is made in the same way as for malaria.

The *treatment* is wholly symptomatic. It differs in no way from that of typhoid fever.

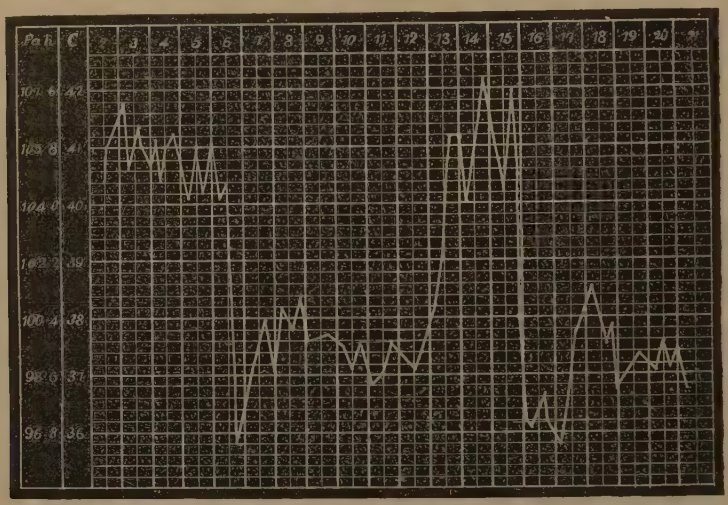


Fig. 147.—Temperature chart, relapsing fever (Seguin).

TYPHOID FEVER.

Typhoid fever (*τῦφος*, smoke; *εἶδος*, like—*i.e.*, like typhus fever); typhus abdominalis, ileo-typhus, enteric fever; German, *Nervenfieber;* Iceland, *landsfarsot*, sickness of the country.—An acute infection, caused by a special bacillus, characterized by slow, insidious onset, hebetude, headache, typical fever, roseola, enlargement of the spleen and mesenteric glands, swelling and sloughing of intestinal glands (Peyer's patches), diarrhœa, meteorism, liability to peritonitis and intestinal hæmorrhage, and termination at about the twenty-first day.

History.—Typhoid fever is a disease of comparatively modern recognition. Although the term typhoïde was proposed by Louis in 1829, the disease was distinctly separated from typhus in the fourth decade, and from recurrent fever in the seventh decade of the present

century. The first attempt at separation of typhoid from typhus fever arose from the recognition of anatomical lesions in typhoid as distinct from typhus fever, first made by Prout in 1804; but the disease, then and for a long time after regarded as a milder variety of typhus, was clinically distinguished only in 1840 to 1850 by the observations of Gerhard and Pennock, of Philadelphia; Shattuck, of Boston; and Barlow and Jenner, of London. The Bacillus typhosus was discovered by Eberth and verified by Koch in 1880. Very fine illustrations of the lesions of the intestines are to be found in the "Medical and Surgical History of the War of the Rebellion," 1888, by Charles Smart, Surgeon U. S. A.

Etiology.—Typhoid fever is the most frequent of all the acute, grave, infectious diseases. It attacks all ages, but spares the extremes of life. One-half of all cases occur between the ages of fifteen and twenty-five; one-fourth under fifteen; one-tenth between twenty-five and thirty. Liability begins to cease at thirty-five, and is almost null at fifty. Yet cases do occur in the most extreme age, as verified by autopsy. So, too, cases have been recognized in early childhood. One should be slow in childhood, and extremely loath in advanced age, to accept the diagnosis of typhoid fever. Most of the cases of so-called typhoid fever in infancy and age are typhoid states of other diseases—pneumonia, tuberculosis (marasmus), etc. The disease may occur at any time of the year, but prevails especially during the fall and winter. It coincides with stages of low water. Typhoid fever is now known to arise only from itself, and to be chiefly conveyed by drinking water (including diluted milk) contaminated with the fæces of typhoid-fever patients.

Bacteriology.—The typhoid bacillus—Koch-Eberth bacillus—is a short, thick rod with rounded ends, three times as long as broad, rendered easily visible by saturated alcoholic solutions of methylene blue. Vacuoles in the ends of the vessels are taken for spores. The bacilli are recognized *en masse* in the intestinal wall; in the plaques and follicles; in the mesenteric glands, spleen, whence they have been withdrawn in life; much less abundantly in the liver, lungs, brain (meninges), and kidneys (urine). They have been recovered occasionally also in the fæces, and have been absolutely recognized in the spots of roseola which belong to the disease. They may pass the placenta, presumptively only after some lesion of its structure, for they have been found in the blood of the fœtus. This bacillus is endowed with motion, grows rapidly upon various culture soils, especially upon the cut surface of a sterilized potato, where it forms yellowish, circumscribed colonies

FIG. 148.—Typhoid bacillus. Pure culture.

so characteristic as to distinguish it in doubtful cases. The typhoid bacillus continues to grow in the presence of acid of high degree. It will show all its characteristics in an acidified gelatin highly

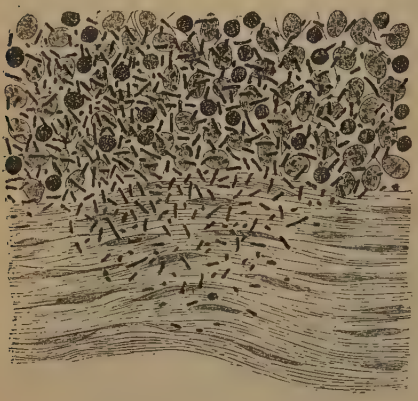


FIG. 149.—Typhoid bacilli in the wall of the intestine.

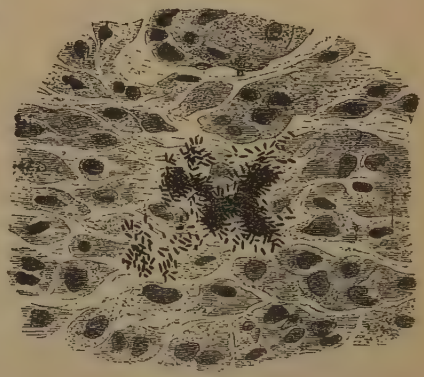


FIG. 150.—Typhoid bacilli from section of spleen (Flügge).

colored with methylene blue, which simulating bacilli will not (Uffelmann). Other bacilli of the colon decompose glucose with the evolution of gas; the typhoid bacilli do not (Theobald Smith). (Vide Frontispiece, Figs. 9 and 15.)

It was difficult to fulfil the three postulates required to establish the pathogenetic nature of the typhoid bacillus, because animals seem naturally immune to the disease, and because an active gastric juice destroys the bacillus. But when the acidity of the gastric juice is neutralized with soda, and the peristaltic motion of the intestine is checked by the use of opium, or if the culture soil containing the bacillus be introduced directly into the duodenum, certain characteristic symptoms supervene, as alteration of Peyer's plaques and swelling of the mesenteric glands, etc.

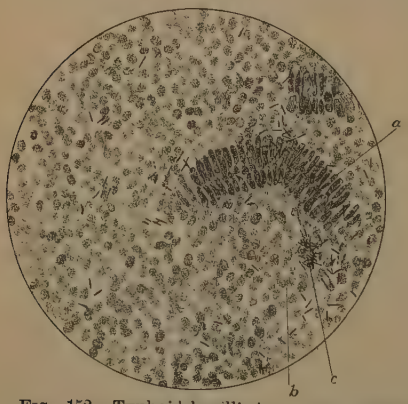


FIG. 152.—Typhoid bacilli in mucous membrane of small intestine (child): *a*, epithelium of crypts, *b*, small round cells like adenoid bodies; *c*, typhoid bacilli in colonies.

Sirotinin, Beumer, Peiper, and others made the important discovery that the culture soil, sterilized by heat enough to destroy the typhoid bacillus, produced, when injected, the same symptoms; so that the poison of typhoid

fever is known to be a chemical agent, the so-called typhotoxine, since extracted (Brieger), which produces the fever, the nervous symptoms, and other conditions which distinguish the disease. The micro-organism finds its way from the discharges into the drinking water, and is thence conveyed into the body of man to produce the disease. The bacillus of typhoid fever does not live very long in drinking water, perishing, as a rule, in from seven to fourteen days, so that the spread of typhoid fever to endemic or epidemic proportions implies a continued contamination of the drinking water. Under favorable conditions, as in dung heaps, sewage, etc., the bacillus may live as long as three months, the outside limit of life (Karlinski). Boiling water thoroughly destroys this bacillus and purifies it for drinking purposes.

Symptoms.—The period of *incubation* of typhoid fever varies from two to three weeks, during which time the individual affected

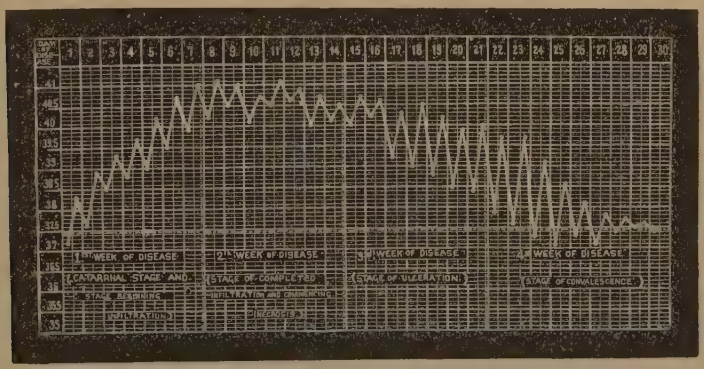


Fig. 152.—Typical temperature curve in severe typhoid fever (Eichhorst).

may present few or no alterations from health. In most cases, however, there is, during this whole period, more or less malaise, languor, debility, headache, neuralgic pain, anorexia, and constipation or diarrhœa. The disease sets in with a *chill*, or series of shivering fits, and, as a rule, a *prostration*, to such a degree as to early put the strongest men to bed. In about one-fifth of the cases the disease is announced by an *epistaxis*, and, in the absence of free hæmorrhage, scales or stains of blood about the nose and the fingers, which have been used to relieve irritation, are suggestive signs to the observant practitioner. The *typhoid state* early assumes prominence. As stated, at times during the whole period of incubation—in nearly all cases with the earliest inception of the disease—there is *drowsiness, dulness, languor, headache*, inability of concentration, apathy, and depression of spirits. This condition exists from the start in greater

or less severity, and prevails throughout the disease, to deepen often later in its course into states of *muttering delirium*, mania, and coma.

The factors which assume prominence at once are those which have given the name to the disease—namely, the typhoid state and the fever. The *fever* of typhoid fever is peculiar. The disease distinguishes itself in all its symptoms by insidious development, and the slow onset is manifest also in the fever. The fever rises, as a rule, a degree a day for seven days. It is one degree higher in the evening than in the morning of the same day, and one degree higher in the morning than the morning of the previous day, so that the typhoid-fever curve is often said to show a stepladder ascent. The height which the fever attains by the end of the first week is something of an index of the gravity of the case. By the end of the first week the fever becomes more or less continuous. It shows the diurnal variations, but, barring complications, it holds itself on an elevated line, four to six degrees, above the normal for two weeks. Then, by the end of the twenty-first day, the fever falls. It may reach the level of the previous night for two or three successive evenings, but it falls lower every morning, until in the course of another week, by the twenty-eighth day, it reaches finally the normal grade. Thus typhoid fever is often divided into weeks: first a week of ascent, second the two weeks of continuous elevation, third the week of marked remission up to the conclusion of the disease. These weeks correspond quite closely to the anatomical lesions in the intestinal canal. During the first week the glands and follicles are in a state of hyperæmia; during the second week there is associated tumefaction; during the third week the glands slough; during the fourth week they cicatrize.

Typhoid fever shows early a symptom of importance in an *enlargement of the spleen*. The spleen begins to swell in the first days of the disease, and by the end of the first week may be recognized as substituting its dulness for the tympanitic resonance of the fundus of the stomach, as it begins to encroach upon the abdominal cavity.

Typhoid fever is often distinguished as ileo-typhus because of the localization of its lesions about the lower region of the ileum. The bacillus passes the stomach, upon which it can produce no effect. It is hurried on by the more rapid peristalsis of the duodenum, jejunum, and upper to the lower part of the ileum, where obstacle is offered to rapid escape of the fluid contents of the stomach by the ileo-cæcal valve. Here, at this comparatively stagnant reservoir, the bacillus makes its attack upon, or is incorporated in, the intestinal wall, to be carried thence through the blood and lymph vessels to

the mesenteric glands and spleen. Symptoms on the part of the intestinal canal present themselves therefore early, assuming prominence later in the course of the disease.

Some few exceptional cases are marked by constipation during the first week, but as a rule *diarrhœa* exists, often early, always later, sometimes profuse in the later period of the disease. The abdominal wall soon becomes distended. There is *meteorism*. Percussion is tympanitic. There is tenderness to pressure. There is gurgling in the region of the right iliac fossa.

The disease is called ileo-typhus, typhus abdominalis, as distinct from typhus exanthematicus, fleck-typhus, spotted typhus or fever, because of the prominence of the eruption in typhus fever. But typhoid fever is not without an eruption. Typhoid fever has a quite characteristic *eruption*, which appears upon the surface of the chest or abdomen, about the region of the diaphragm, in the form of small red spots, "rose-colored, lenticular spots" (Louis), which appear to the number of five to fifteen distinctly macular, subsequently slightly elevated spots, like flea-bites, which disappear upon pressure, to reappear with its relief. These rose-colored spots, scattered usually over the chest and abdomen, have at times a more profuse and wider distribution. They may appear first in the loins, and may be observed only on inspection of the back. They may extend over the chest, over the whole abdomen and upper part of the lower extremities, and be even crowded over upon the neck to the number of several hundred. They may appear, disappear, and reappear in the further course of the disease. They are present in the majority of cases, and form, while not pathognomonic, certainly strong corroborative evidence of the nature of the disease. Cases sometimes show no spots. Chomel speaks of an epidemic at Turenne where spots appeared in no case. They do appear in the great majority of cases, and at about the period of the disease mentioned, and are strong points in the recognition and diagnosis of typhoid fever.

The *discharges* of typhoid fever are more or less distinctive. They consist at first of the natural contents of the intestinal canal. Later they become more fluid, assuming a distinct consistence and color. The old writers spoke of the "pea-soup, ochre-colored" discharges of typhoid fever. This character is sometimes markedly changed by the appearance of blood. Some *blood* appears in the discharges of nearly all cases of typhoid fever, but, as a rule, in minute quantity. Discharges are called bloody only when the blood may be recognized with the naked eye. The discharges in typhoid fever are frequently stained with blood, or contain blood in quantities, or consist wholly of blood. Individuals have succumbed to hæmorrhage in this way. The rule is, that the discharges are

bloody for a time, several days, that hæmorrhages occur during this period, that the bleeding ceases probably with the block of the vessel, to recur with dissolution of the clot, or with the reopening of an ulcer, or from a new ulcer.

All this time the typhoid state deepens. The patient complains at first only of headache, of drowsiness, or his sleep deepens into states of stupor. After a while the condition continues more permanently ; the patient is in a more or less constant state of *vacancy* or *stupor*. If spoken to or sharply addressed he may answer rationally at first, or later make some unintelligible or irrelevant response. If asked to protrude the tongue he may fail at first to comprehend, but if the request be made manifest by pressure of the finger upon the chin, the tongue is with effort protruded, as a heavily coated, fuliginous, tremulous mass, which remains protruded until the patient is admonished by injunction or touch to withdraw it. The patient falls into a state of mild delirium. He seems constantly and incessantly occupied. The mind is busy, in the strict sense of the term—so busy as to prevent sleep. There is low, muttering delirium, a state of stupor with vigilance—a condition which is well described under the term *coma-vigil*. The body becomes more and more an inert mass. There is no effort on the part of the patient. The most imperative wants of the body pass unrecognized. The discharges are voided unconsciously and involuntarily. The patient slips down in bed, and must be continually lifted toward the head of the bed. Flies crawl unnoticed over the face. There is no perception of heat or cold. All the while the mind seems intently preoccupied. Soon there is subsultus tendinum. The patient picks at the bedclothes. The face is dusky. The prostration is profound. Heart failure or thrombus may close the scene.

Fortunately such cases are rare in our day. The old pictures of cloud and collapse are seen only in neglected cases, especially in cases which remain as long as possible out of bed, whereby the strength which should be saved for resistance is wasted away, whereby also tendency to hæmorrhage or peritonitis is increased.

Hæmorrhage and *perforation* are the accidents most to be feared. Slight hæmorrhage may show at any time in the course of the disease, but such an amount of blood as to be visible to the naked eye, or to constitute most or all of the discharge, occurs, as a rule, in the third and fourth weeks of the disease, and is due to the erosion of a blood vessel or the reopening of a cicatrization. A hæmorrhage is recognized at once by the presence of blood, or, if the blood be concealed—that is, retained in the intestinal canal—by the collapse into which the patient sinks ; by the fall of the temperature suddenly from 104° or 105° to 100°, to the normal, or even to

subnormal grades. There is, after such copious hæmorrhage, an illusory improvement in the mental state. The patient awakens from coma, or appears more rational and bright. The temperature, however, speedily reaches its former, or often higher, level, and the strength and the mental state are reduced more than before. While it is a rule that hæmorrhage occurs more especially in bad cases, there are many exceptions. Fatal hæmorrhage has taken place in cases so light as not to have confined the patient to bed, and patients have even bled to death from a single ulcer. But the hæmorrhage is by no means necessarily fatal. The usual history of a hæmorrhage is its occurrence in quantity, disappearance for several days, and recurrence perhaps on several subsequent occasions. The stools of a single day, or of twenty-four hours, are bloody or all blood. On the following day the condition is more normal. On a subsequent day the hæmorrhage returns.

Of all the accidents that befall a patient with typhoid fever none is so grave as *perforation*. This accident, as a rule, occurs in close proximity to the ileo-cæcal valve, where the ulcers are most abundant and deep. The condition is announced, for the most part, by sudden, profound collapse. The face is pinched, the eyes sunken; the surface is cold, often clammy; the pulse is feeble or almost imperceptible, thready. The patient often lies in bed with the knees flexed to relax the abdominal wall. The abdomen itself is distended, tympanitic. The dulness of the liver and spleen is substituted by tympanitic resonance. A mistake may here readily arise from a distended colon, which may itself substitute the hepatic and splenic dulness. In perforation the temperature usually falls suddenly, and often to a subnormal degree. The patient may become rational. There is an illusory appearance of resolution of the disease. These hopes are, however, speedily abandoned, as the collapse continues, to end in death in twelve to twenty-four hours.

Peritonitis by no means of necessity implies a perforation. An ulcer may affect the peritoneum without perforating it. In this case, for the most part, the peritonitis is circumscribed, and points or surfaces of tenderness may be elicited by gentle pressure over the abdominal wall. A circumscribed peritonitis may become diffuse when no perforation exists.

Typhoid fever presents two sets of *complications*—one which applies to the disease proper, and one common to other infections. The lesions peculiar to the disease include the swelling and ulceration of the glands in the intestine, and affection of the spleen and other lymphatics. The second set of lesions are the *parenchymatous degenerations*, that have been usually ascribed to the height and duration of the fever, but are considered in our day to be

due to the poisoning of the blood. These states affect chiefly the muscles, which undergo granular, fatty, and waxy degenerations, to such a degree at times as to lead to paralysis, ruptures, and failures. Thus the heart may become feeble or cease to beat, the diaphragm enfeebled or paralyzed, and voluntary muscles may rupture. The author has seen rupture of the rectus abdominis.

Typhoid fever is a treacherous disease, and no disease is attended with so many pitfalls in the way of complications and sequelæ. Hæmorrhage, perforation, peritonitis, may occur in any case unexpectedly. Among the more uncommon *sequelæ* may be mentioned laryngitis, which may assume a diphtheritic character and necessitate tracheotomy. Parotitis on one or both sides sometimes proceeds to suppuration, probably as the result of a mixed infection. About once in a hundred cases there occurs thrombosis of the femoral vein—phlegmasia alba dolens. Although albuminuria occurs in perhaps every case at the height of the fever, typhoid fever is very rarely followed by Bright's disease. Pyæmia occurs as a rare exception. Bronchitis belongs to the disease, and lobular pneumonia may result from it. Pleurisy, pericarditis, endocarditis, are among the rarer complications. So certain cases of valve disease of the heart owe their origin to typhoid fever. Bed sores are common, and show themselves in aggravated form in protracted cases, defiant of all relief at times until the period of natural resolution, when they are wont to take on a new aspect and heal up.

Typhoid fever shows itself in various *forms*. There is : 1. The abortive form, in which the disease, while commencing violently and showing all its signs, terminates at the end of the second week. These cases are not so uncommonly rare. Protracted forms, where the disease extends into the fifth or sixth week and beyond, are by no means rare, and must not be confounded with relapses, which imply a previous return to the normal temperature. 2. The fulminant form, where life is taken in the course of a few days, as under the action of a virulent poison. 3. The disease differs somewhat in children, in that the eruption is by no means so abundant or distinct. The onset of the disease is more abrupt, the pulse and heart's action are not so much enfeebled. 4. In the aged the fever is not so high, diarrhœa is not so severe or persistent, eruption is not so abundant or distinct. There is more apt to be earlier and longer-continued muttering delirium. Prostration comes on quickly and continues after the subsidence of the fever, while other nervous symptoms of a low character—tremors, subsultus tendinum, etc.—are more constant.

Such cases are only to be considered *relapses* wherein, as stated, the temperature reaches the normal grade. Testimony dif-

fers as to the frequency of this accident, and confusion has arisen in regarding or not as relapses those recrudescences of fever which may be provoked by errors of diet, exciting causes, emotional anxiety, premature physical effort, etc. In these cases the fever subsides in the course of a few days, whereas in the true relapse the whole scene is repeated in at least a great part of its rôle. Relapses usually begin more abruptly, the temperature sooner reaches its maximum grade. The rose-colored eruption appears earlier, even on the second or third day; the disease subsides more rapidly. Thus the duration of the case may extend to include two or even three distinct attacks of the disease. An abortive case may be followed by distinct attack, or the case may consist of a distinct attack followed by two abortive relapses.

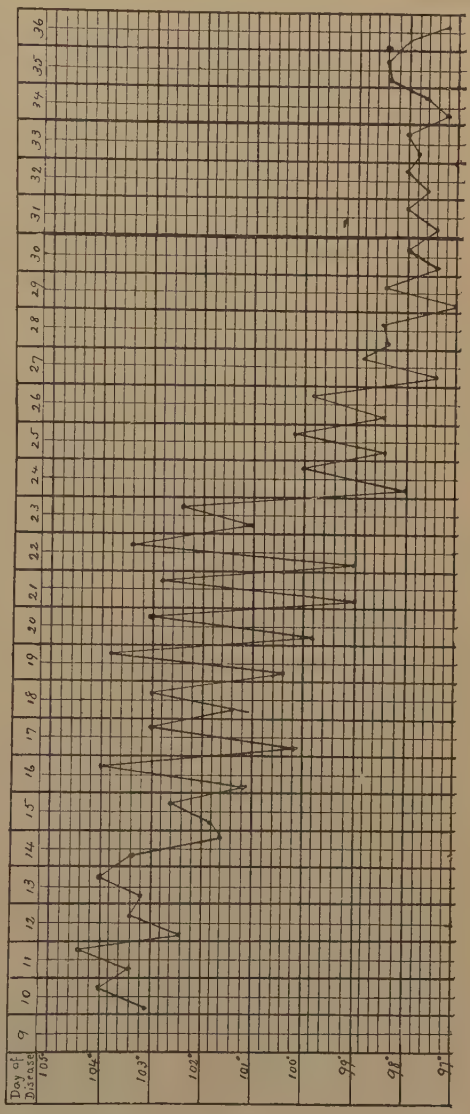


FIG. 153a.—Typhoid fever with recrudescence. Primary fever. (Vide p. 278)

Typhoid fever, as a rule, lasts twenty-one days or thereabout—that is, the fever begins to break on the twenty-first day, to terminate by the twenty-eighth day, so that the average duration of the disease may be regarded as about one month. Complications may vastly prolong its duration. Death may occur at any period of the disease, rarely before the end of the first week. Death may occur, again, several weeks after the disease has run its course, as the result of some sequel.

The *diagnosis* rests upon: 1. The typhoid state—*i.e.*, the dulness, headache, insomnia, etc. 2. The fever with its gradual ascent and sustentation at a plane much above the normal for three weeks. 3. The abdominal symptoms, the diarrhœa, the stools, meteorism,

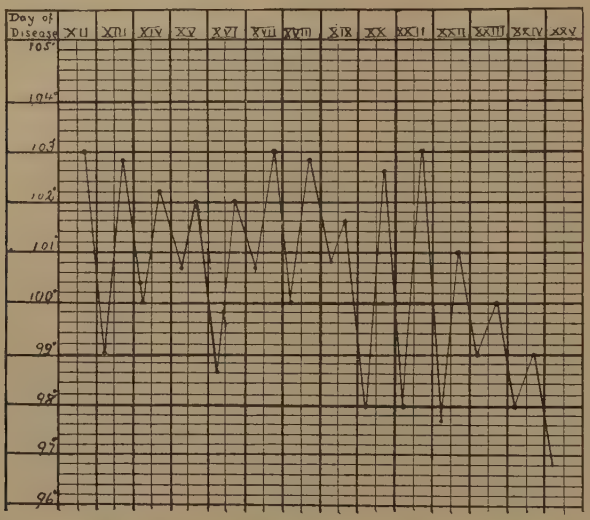


FIG. 153*b*.—Typhoid fever with relapse after twenty-four days' interval. Relapse (Moore).

enlarged spleen. 4. The roseola. 5. The complications, especially the hæmorrhage, heart failure, peritonitis. 6. The bacillus extracted from the spleen.

Prognosis.—From what has been said regarding complications of

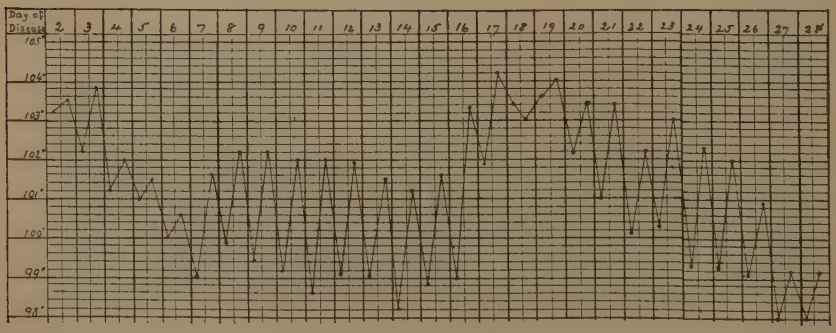


FIG. 154.—Typhoid fever with recrudescence.

typhoid fever, it must be regarded always as a very grave disease. The prognosis must be guarded. In childhood the prognosis is by no means so grave. Accidents and complications are much less

frequent. Nearly all children recover. At puberty the disease begins to assume gravity, and the gravity increases with advancing years. We base the prognosis, 1, upon the degree of fever. Fiedler says that all cases die when the fever once touches a temperature of 107°; one-half die at 106°, one-fourth at 105°. Murchison reported a recovery after a temperature of 108°. Hutchinson states that the highest temperature reached in any of his cases was 106°. In this fatal case the temperature reached 105° five times. So single elevations of temperature to extreme degrees indicate gravity in this more than in any other febrile disease. Unusually protracted temperatures, though far less high, into the fourth week and beyond, give great gravity.

The prognosis is based, 2, upon the character of the complication. A new gravity is imparted to the case by hæmorrhage. Cases in which hæmorrhage is profuse or repeated furnish a mortality of thirty to forty per cent. Peritonitis is very grave. Perforation is not quite, but is almost, necessarily fatal. Rare cases are rescued by agglutinative inflammation. 3. The condition of the heart is a criterion of the danger. The pulse seldom rises above 100 to 120 throughout the course of typhoid fever. The more frequent pulse betokens gravity. The strength of the heart's action, independent of its frequency, is an index of the gravity. 4. The time when a patient is put to bed determines to a great degree the future of the case. Hospital cases which go to bed late have, notwithstanding care and skill, a greater mortality than cases in private practice which are put to bed at once. An early decubitus economizes force as well as prevents complication.

Lastly, the outlook of the case is determined by its surroundings. The prognosis of typhoid fever depends largely upon the attention which it may receive. Under the improved methods of treatment of the present day the mortality of typhoid fever is reduced to seven to ten per cent.

Prophylaxis.—Typhoid fever is a preventable disease. With our knowledge of the nature of its cause, it is necessary to secure pure drinking water to prevent typhoid fever. To avoid contamination of drinking water by human excrement rescues a community from the dangers of this disease. Where this condition cannot be complied with, thorough boiling of the water destroys the parasite which produces it, and renders the water safe. So, also, perfect filtration through porcelain or asbestos prevents the passage of the germs. Unfortunately the disease occurs, at times, where these precautions are taken, by neglect of the milk, which is often diluted with contaminated water. The disease may be contracted, where even this precaution is observed, by the ingestion of drinking water elsewhere than at home.

Prophylaxis includes cleanliness about the sick-room, especially

with regard to the bed linen and the utensils employed in the treatment of the disease. Washerwomen, by careless handling of linens, often contract the disease by direct infection.

The *treatment* of typhoid fever is wholly symptomatic. The hopes entertained regarding the jugulation, mitigation, or abbreviation of the disease with specifics have proven groundless. The preparations of iodine, carbolic acid, calomel, hydronaphthol, etc., have been recommended as antimycotic agents, but without evidence of real value. When it is remembered that typhoid fever is a disease of long incubation, that the poison is received into the body at least two weeks before the manifestation of symptoms, by which time microorganisms have penetrated into the recesses of tissues out of the reach of remedies introduced into the intestinal canal, it may be understood why hopes of parasiticidal agents may not be entertained. More is to be expected of some protective proteid or antitoxine, and hope is entertained that available antitoxines may be extracted from the blood of patients who have just survived or recovered from the disease.

As stated, the success of treatment is based largely upon the surroundings of the patient. After the diagnosis is established, treatment of an ordinary case, aside from complications, is more a matter of good nursing than of scientific skill. The temperature of the room should be maintained at 68°, as established by a thermometer at the head of the bed. Ventilation must be secured from outside air. The bedroom should be faultless in its cleanliness, and, with the linen of the patient, should be changed, where it is possible, every day. An additional bed, sofa, or lounge, to which the patient can be transferred absolutely without effort on his part, best secures this object.

A typhoid-fever patient must go to bed at once, and remain in bed, without rising under any pretext, throughout the whole period of the disease. Hæmorrhage and perforation, the evils most dreaded in this disease, occur much more frequently in patients who change posture than in those who lie recumbent and at rest.

The *diet* must be fluid. Milk is the food *par excellence* when not especially contra-indicated, as by natural aversion, too much constipation, etc. Under such circumstances, or even when the milk is well borne, it may be substituted or supplemented by beef tea, chicken soup, mutton broth, oyster soup, and later, in beginning convalescence, diluted eggs and thin custards. Fermented milk, sour milk, buttermilk, koumyss, may be taken when other preparations pall. Solid food is on no account to be administered to a typhoid-fever patient until the temperature shall have remained in convalescence for three days at the normal grade. Fluids must be given to a typhoid-fever patient regularly. Cold water must be accessible, fresh, pure cold water, at all times; and in the states of pre-occupation,

delirium, coma, cold water must be not so much offered as administered at regular times. A grateful drink, in the absence of diarrhœa, is the prescription of Cheyne as improved by Graves:

℞ Sodii carbonatis..... 3 i.
Succi limonis ..... ℥ i 3 vi.
M. et adde,
Tincturæ aurantii recentis..... 3 ij.
Syrupi aurantii..... ℥ ss.
Aquæ.....ad ℥ vi.
M. S. A wineglassful every three or four hours.

Graves says nothing is more agreeable to a fever patient than this mixture. The citrate of sodium thus formed "tends to keep up a soluble state of the bowels and forms a most grateful and refreshing beverage." The mouth should be washed out two or three times a day with solutions of borax. Vaseline, or, better, borated vaseline,

℞ Acidi borici.....gr. xv.
Unguenti petrolati,
Lanolini.....aa 3 ij.

is to be introduced at the nostrils, not deeply inserted, to liquefy and disseminate itself through the nasal fossæ and the pharynx. The face, neck, and chest should be sponged with fresh water or with Cologne water two or three times a day.

The conditions which may call for special treatment are, first, the typhoid state and the fever. Some hebetude, headache, drowsiness belong to every case and call for no treatment. Headache in excess may be controlled by moderate doses, gr. x.–xv., of the bromide of sodium, largely diluted, every three or four hours. Light delirium may be met in the same way. Vigilant states may be combated by sulphonal, gr. x.–xv., in a bowl of warm milk or a cup of hot tea; trional, gr. xv., or, in the earlier periods of the disease, by chloral, gr. v.–xv., in half an ounce of peppermint or orange-flower water. Nervous distress is best controlled by small gr. ij.–v. doses of pure chloral. When these hypnotics fail resort must be had to morphia, gr. $\frac{1}{6}$–$\frac{1}{4}$, administered, where the tongue is dry or in the presence of nausea, preferably subcutaneously. Morphia may become in certain cases indispensable, but should be used only after failure of milder means, and always with judgment. In the rarer cases of maniacal excitement necessary supervision must be secured.

Some fever belongs to the disease and may be allowed to run. Fever above 103° in the rectum becomes excessive. The dangers of typhoid fever are no longer attributed to the fever. The fever is looked upon, not as the cause, but as the effect of the poison of the disease, as a coeffect with other symptoms; and while it is true that the range of the fever is a gauge of the gravity of the disease, it is

not true that the control of the fever subdues the disease or controls the condition. The fact is that in our day treatment of the fever is more an address to the comfort than the safety of the patient.

The best antipyretic is the cold bath. To be effective the patient must be lowered by sheets, held at the four corners, into a full-length cold bath, where he is to remain at first five, then ten, later fifteen minutes or more, when he is to be removed to bed with the same care, gently wiped off, covered with blankets, and allowed, if he may, to sleep. The bath is cold when the temperature is 68° F. It is sometimes advisable to commence with a warmer bath, 75° to 80°, even 90°, and gradually cool it down with lumps or masses of ice. The bath should be administered whenever the temperature reaches 103° *in the rectum*, where alone reliable records can be read, every hour if necessary, precaution being taken to secure the advantage of the bath between midnight and morning hours, as well as at other periods of the day. The cold bath strengthens the heart and increases the excretion by the kidneys of typhotoxines (Roque and Weill).

Where reaction is slow to establish itself, a tablespoon or two of whiskey diluted should be given to the patient both before and after the bath. The cold bath reduces the temperature two or three degrees, as a rule, and brings it down often to the normal, sometimes to subnormal grades, where it will likely remain for an hour or two. To be effective it must, as stated, be repeated throughout the day and night. Cold baths and alcohol make now almost routine practice. Both give comfort and safety. There must be care with chloral in late stages of the disease.

Peritonitis, whether from perforation or not, hæmorrhage, constitute about the only contra-indications. So far from increasing, it has been proven that the cold bath actually lessens the liability to hæmorrhage of the bowels. No remedy that we possess secures the advantages and avoids the disadvantages of antipyresis so effectually as the cold bath. The cold bath is sometimes impracticable and impossible, whether from prejudice, absence of apparatus, or condition of body, and in these cases resort must be had to other agents. Sponge baths and wet sheets are poor substitutes for the bath. The safest of the modern antipyretics is phenacetin, which is best given in a large dose, three grains to a child, five grains in adolescence, ten grains to an adult, at the height of the temperature, which it will reduce, in the course of fifteen or twenty minutes, a degree or two, with some slight sweating, which in turn aids in sustaining the antipyresis. Antipyrin or antifebrin in half the dose of phenacetin secures the same advantages, but with a more depressing effect upon the heart. These depressions may be counteracted by alcohol, whis-

key, a teaspoonful to a tablespoonful diluted, in which case there is not much choice between the remedies. Aconite and veratrum, on account of damage to the heart, are no longer given in typhoid fever except in infinitesimal doses, *ut aliquid faciat,* in which case they may be better substituted by dilute hydrochloric acid, gtt. ij.–v., diluted in a tablespoon or wineglass of water. The modern antipyretics have the additional advantage that they possess some anodyne properties and thus allay insomnia, headache, neuralgic pains, while they reduce fever. A dose of phenacetin used with judgment at the proper time will give comfort in the course of typhoid fever.

The time for stimulation arrives in the course of nearly every case of typhoid fever. This time is indicated, first, by the character of the pulse, which begins to flag in its force. Perhaps the first signal of its weakness is shown in the condition known as dicrotism, or reduplication at the radial pulse. The force of the heart is estimated readily also by the degree of compression necessary to obliterate the pulse with the finger. The degree of weakening or faintness of the pulse, which follows the lifting of the right arm at right angles to the body, indicates its strength.

Alcohol is the best whip for a flagging heart—in a mild case in the form of wine, especially sherry or Madeira; in a severe case in the form of whiskey, which may be given as milk punch or as a cold drink with ice water, or, as it may be made more palatable by the addition of sugar and lemon juice or some bitter (tincture of nux vomica), as a cocktail. In the most prostrated cases the alcohol should be in the form of brandy. A threatened collapse may be bridged over by a cup of black coffee with a teaspoonful of cognac, or resort in the extreme cases must be had to the analeptics, as the oil of camphor 1 : 10, or tincture of camphor or musk. Whiskey may be injected into the bowel or administered subcutaneously. Nitroglycerin 1 : 100, in dose of gtt. i.–iij. in whiskey, is one of the most powerful agents we possess. It may be administered also in the same dose under the skin. It is especially indicated when the urine is scant.

Diarrhœa seldom calls for treatment. A moderate diarrhœa belongs to typhoid fever and should be let alone. It carries off noxious matter. Excessive diarrhœa is best restrained by bismuth gr. x.–xx., lime water with milk, or by a small dose of the camphorated or simple tincture of opium; or,

℞ Acidi hydrochlorici diluti..... gtt. xl.
Tincturæ opii..... gtt. xl.-lx.
Aquæ camphoræ..... ad ℥ iv.
M. S. Tablespoonful every two to six hours.

A dry tongue with sordes and muttering delirium is an indication

for turpentine gtt. x.–xx. in milk, or hydronaphthol gr. v. every two to four hours.

Constipation belongs often to the first week of the disease, and disappears of itself later without treatment. Should it become troublesome it may be relieved by enemata rather than by drugs. Protracted constipation is due, as a rule, to error in diet, more especially to too long-continued or exclusive use of milk, and may be often counteracted by the substitution of other fluid food. Calomel, gr. i.–iij., is never harmful in the first week, when it sometimes clears up comatose states.

Complications call for treatment according to their character. Hæmorrhage demands more absolute rest and the avoidance of all food. Ice dissolved in the mouth may relieve or lessen thirst. Ice bags may be put over the belly at the region of the ileo-cæcal valve. Peristalsis should be arrested by opium. No form is better here than the simple tincture gtt. x.–xx., or camphorated tincture ʒ i., repeated as may be deemed necessary. Ergotin, or preferably sclerotinic acid, in syringeful doses, may be injected under the skin of the abdomen every fifteen to thirty minutes. Rescue may be had at times by transfusion of warm salt water, one drachm to the pint, the water having been previously boiled. Subcutaneous injection sometimes suffices as well as intravenous, without its dangers. Perforation calls for opium almost up to narcosis. In the light of present evidence it is quite justifiable to cut down upon the intestine in the hope of finding the seat of perforation or source of excessive hæmorrhage. But let medicine be not brought into disrepute by surgery *in articulo mortis!* The convalescence is long. It is often pleasant, sometimes tedious, and always subject to relapse. It is impossible to exercise too much restraint in the matter of diet and muscular effort in the earlier period of convalescence. Patients in typhoid fever should only very gradually get upon their feet.

The dilute hydrochloric acid, five to ten drops in a wineglass of water before meals, best aids the digestion of food taken, with, as a rule, an appetite increased to voracity, whereby the patient often gains a pound a day. It is common observation that patients have a more robust health and vigorous intellect, possibly from the destruction of some previous poison, probably on account of the long rest of mind and body, after typhoid fever than ever before.

MALARIA.

Malaria (*mal-aria*, bad air); ague; German, *Wechselfieber.*—A disease caused by infection of the blood, especially the red blood corpuscles, by certain animal organisms (protozoa); marked in typical

cases by attacks of chill, fever, and sweat, in irregular cases by neuralgias and various nervous phenomena, and in more protracted cases by marasmus and enlargement of the spleen. The predominating element in symptomatology of whatever character is periodicity, with intervals of more or less complete absence of symptoms. The pathogenic micro-organisms disappear from the blood and the symptoms of the disease subside under the influence of quinia.

History.—Forms of malaria were known in the most ancient times. Protagoras described the drowsiness and coma of pernicious fever. Celsus recognized the quotidian, tertian, and quartan types. Archigenes observed various masked forms, and Rhazes put upon record cases in which one attack followed so close upon another as to constitute the subintrant form.

Rome was early the seat of malarious disease. The waters which poured down from the Palatine, Aventine, and Tarpeian hills formed marshes, emanations from which developed the disease. The elder Tarquin drained Rome with subterranean sewers—which, from their extent, Pliny likened to subterranean streets—with the effect of freeing the city from malaria to such an extent that, by the time of the Cæsars, Rome contained more people than any city before or for centuries after. With the invasion of the Goths the sewers were blocked and Rome again became a centre of malaria. The country about Rome, the Pontine marshes, have long been famous as hotbeds of malaria. Appius Claudius drained the marshes into the Tiber, built bridges and the celebrated Way, which still remains, so that the country became the seat of an extensive population. Under Theodoric the drains were broken up, plains were converted into marshes, and the Maremma became malarious to such degree as to render it, as it yet remains, practically uninhabitable. The cause (plasmodium) of malaria was discovered by Laveran (1881).

Etiology.—From all time it has been recognized that marshes breed malaria. Ever since the days of Hippocrates it was remarked that while the average mortality is one in thirty-four, that in marshy countries is one in twenty. Marshes are to be found in nearly every country. In India, one hundred and eighty-four square miles south of Calcutta, lies the vast marsh of the Sunderbund, twenty thousand square miles in extent, a breeding place for malaria as well as cholera. The deltas and embouchures of rivers spread with their detritus marshes over vast areas; thus in China at the mouths of the Blue and Yellow Rivers; in Africa, of the Orange, Zais, and Zambesi; in South America, the Amazon, Orinoco, Rio del Norte; England has its fens of Lincolnshire and Norfolk. In our own country the swamps and bayous overflowed and bared annually by the large Western and Southern rivers are perpetual homes of malaria. Per-

haps nowhere upon earth do the conditions exist that produce the disease in such virulence and constancy as in Central America, where workmen upon the great canals have to be substituted every few months.

Heat, moisture, and vegetable decomposition are the factors recognized as essential to the production of malaria, so that the disease finds its limit, on account of temperature alone, at 63° North and 57° South latitude. The cause of the disease is heavy and hugs the ground. It may be transported by winds, but, as a rule, *altitude* exempts from malaria. This altitude must be greater in proportion as the malarial infection is most intense. It must be greater and greater toward the equator. Near Rome is the elevation of Tivoli, one hundred and sixty-five yards perpendicular height, where malaria still exists, but in much less intense degree; beyond is Monte Mario, two hundred and thirty yards, where fewer and fewer cases are found; while further off is Serre, three hundred and twenty yards, absolutely free of malaria.

It is estimated, as a rule, that the necessary altitude to secure exemption is, in Italy, ten or eleven hundred feet; in the Pyrenees, five thousand feet; in Ceylon, sixty-five hundred feet ; and in Peru, ten thousand feet. The limit to which the disease can be transported by the wind is estimated best at sea. The crews of ships off the coast of Africa secure exemption at a distance of about three thousand feet, and about the same distance is observed, in malarious seasons, off the rocks of Gibraltar. So well recognized is the fact of altitudinal exemption that the inhabitants of intensely malarious countries build their houses above the level of the ground. Thus at Demerara the natives build their huts on corn stalks to lift them above the surface. Soldiers in these countries are not permitted to sleep on the ground floor of barracks.

It is the relative rather than the absolute *humidity* which determines in certain places the production of the disease. Thus in the perfectly dry island of Barbadoes malaria prevails only when the rain falls, a greater part of the year; while in Trinidad, unless the rain falls a greater part of the year, malaria is developed. In Barbadoes any diminution of the rainfall is drunk up and disposed of by the soil, while in Trinidad a diminution of rainfall lays bare vast tracts of marsh otherwise covered with water. The rocks of Gibraltar and the rocks about the Orinoco, considerable elevations, are nevertheless hotbeds of malaria, because the springs which prevail in these places feed the vegetation which forms in fissures and crevices, and, with the abundant moisture and great heat, furnish the requisites for malaria. Malaria has developed also an intensity in sandy plains, as in the English army at Rosendaal. In these cases

water may be found at any place a foot or so beneath the excessively dry surface. The subsoil is really detritus, vegetation originally brought down by the Rhine and Waal, and covered by the winds with find sand, the silt of the sea. These are, therefore, apparent and not real exceptions.

On the other hand, there are places upon the earth where all the necessary conditions seem to exist and yet malaria is absent. Before the gates of Mexico lies the great lake of Tescudo, twenty-five square miles in extent, stagnant, brackish, with abundant decomposing vegetation, subject to the heat of a tropical sun, and yet developing little or no malaria. The same thing has been seen in certain islands of the Pacific, in swamp lands of Australia, Asia, and notably, curious as it may seem, in the well-known marshes of the Emerald Isle. Here are heat, moisture, and vegetable decomposition, but, for some unexplained reason as yet, no malaria. Liebermeister ventures an explanation to the effect that the cause has not yet been carried there. Perhaps there may be discovered other conditions which prevent its growth.

Obstacle is sometimes offered to the transmission of the infection by interposing trees. Malaria prevailed at Villatri until it was intercepted by the growth of a grove of trees, which Pope Benedict XIV. afterward cut down to expose the place to new infection. The ancient temples of medicine, which were sanatoria, were situated on islands and surrounded by trees. The indigo planters are not afraid to dump the refuse of the plant after the extraction of its coloring matter, hotbeds of malaria, in close proximity to their houses, provided there intervene a grove of trees.

As marshes become drained, more especially as cities are built, streets paved, sewers constructed, places and towns previously unhealthy become habitable. Hippocrates says of Abydos that it was freed from malaria in this way. Sydenham declares that in his time one to two thousand people died every year in London. At the present time it is difficult to find a case. So it is noticed in our own country that cases seldom or never develop in the city proper, but in the suburbs and outlying districts, more especially in the valleys of rivers after the recession of overflows.

Malaria has for a long time been supposed to be caused by a *contagium vivum*, with no other positive proof, however, than the isolated experiments of Gerhardt, of Berlin, who succeeded in producing the disease by injecting blood from the spleen of an affected individual into the veins of a healthy man. All efforts to discover any demonstrable and acceptable cause of the disease remained futile up to the time of the investigations of Laveran (1881), a French military surgeon of Algiers, who succeeded in discovering

in the red blood corpuscles peculiar amœboid bodies endowed with characteristic protoplasmic motion and containing granules of pigment matter (vide Frontispiece, Fig. 2). Certain smaller bodies of irregular, semilunar, crescentic outline are also found in the blood plasma, connected together often by fine threads. These bodies are present in the blood of malaria in greatest abundance during a chill, and disappear to a great extent after the attack. Many of them are

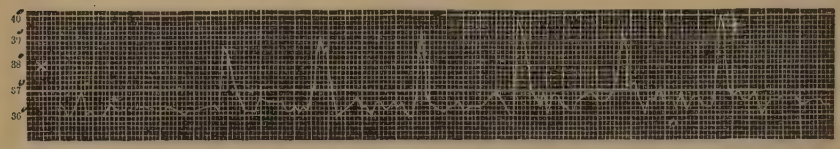


FIG 155.—Temperature curve in man after injection of blood from patient affected with malarial (quartan) fever: × 12, noon, injection of four cubic centimetres blood; + injection of two grammes of muriate of quinia (Bacelli).

clear, more or less spherical, sometimes flagellated, hyaline masses, undiscoverable without the use of dyes. They gradually increase in size until they fill the body of the corpuscle, during which process they undergo peculiar segmentation. The intracorpuscular body receives the name plasmodium. Besides the plasmodium, flagellate structures with three to eight long, active cilia may be seen floating free in the blood of more acute cases, or may be discovered more especially in blood withdrawn from the spleen, which is regarded as the hotbed

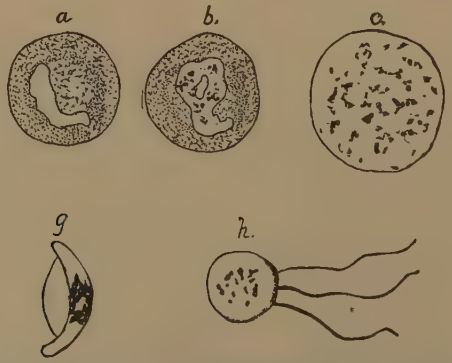


FIG. 156.—Plasmodium malariæ: *a*, *b*, *c*, intracorpuscular bodies; *g*, crescent; *h*, flagella.

of malaria in the body. Golgi claims that the various types of fever, anomalies, etc., depend upon peculiarities or differences in these parasites, and Laveran maintains that the crescentic forms are found only in inveterate and cachectic cases. So, too, it is said that quinine destroys only the plasmodium, and that arsenic has more effect upon the crescentic form. Concentrated aqueous solutions of fuchsin

and methylene blue are the best staining agents for ordinary diagnosis. Fine double colorings are made with eosin concentrated solution in glycerin, with two to five per cent absolute alcohol, and subsequent stain with methylene blue. The specimen, after five to ten minutes in each staining, is washed off and preserved in balsam. After this method the red corpuscles are colored pale red, the nuclei of the white blood corpuscles pale blue, and the parasites a deep blue. The blood is best examined as taken fresh, at the height of fever, from a drop after puncture of the end of a finger, upon a cover glass which is at once covered by another glass, put under the microscope and stained, when the amœboid bodies show themselves in abundance. These bodies disappear after the administration of quinine and arsenic, hence they may not be found in subjects under treatment. Variations in the type of the disease—quotidian, tertian, and quartan—are believed to correspond to varieties in the life history of these structures. As they are found always in malaria, and only in malaria, and disappear from the blood with the cure of the disease spontaneously or artificially, they are believed to be the cause of the disease; but as they have not been discovered out of the body, and as they may not be cultivated in special soils, the mode of ingress is not known. It is probable that these bodies, as such, or in preliminary stage of development, originate in water; that they are then taken up by the air and inhaled into the body of man. It is known that the disease has resulted distinctly from drinking-water, as well as from air. An instructive illustration of this fact is found in the statement of Baudin, who reported the infection of a number of soldiers by the use of drinking-water. The soldiers were being transported from Algiers to Marseilles. From some oversight the water supply was neglected and had to be taken in at a swampy place known as Bona. The crew had their own water, and nine of the soldiers used only the water of the crew. The crew remained entirely unaffected, as did also the nine soldiers, while all the rest, without exception, were taken sick with the disease. Probably malaqua is a name as appropriate as malaria. But in the vast majority of cases the disease is inhaled. Abundant proof of this fact is established by direct observation. Experimenters have exposed themselves for hours, have gone to sleep or spent the night in proximity or in the midst of a marsh, to be taken, in the course of a few hours, with characteristic symptoms of the disease.

Malaria presents itself in a varied picture of forms so different as to seem to belong to different affections, but all resolvable into malaria by the *periodicity* of symptoms or by the success of treatment.

The *forms* which are now recognized are:

1. Intermittent fever with distinct interval.

2. Remittent or continuous fever, where the interval is short or nearly absent.
3. Masked malaria, with an infinitely varied symptomatology.
4. Pernicious malaria, with grave symptoms of blood poisoning.
5. Malarial cachexia.

Intermittent fever begins with a *chill*, which distinguishes itself by its severity, in which regard it is equalled only by that which announces croupous pneumonia and cerebro-spinal meningitis. The cold is so severe as to make the teeth chatter and agitate the body in those violent shivering movements which constitute a chill. The temperature rises during the chill to 104°, even to 105°, and is not increased more than half to one degree during the subsequent fever. Yet the surface of the body remains distinctly cold. The nose is pinched, the eyes are sunken, the cheeks, the tip of the nose, the lobes of the ear are cold, the surface is tinged blue. There is cutis anserina. Cold sensations shoot out from the spinal column through the trunk to the extremities, and may not be overcome or subdued at first by approach to the fire or by any amount of clothing. In bad cases there are, at this stage, signs of distinct collapse: the heart's action becomes feeble, the pulse flutters, there is profound prostration of strength and almost entire abolition of the voice. In the course of half an hour to two hours the chill gives place to a second stage, the *fever*. Sensations of heat now shoot out from the spine, at first as agreeable substitutes for the extreme cold. For a time flashes of heat and shivering fits may alternate. Soon the heat assumes the mastery; the surface is supplied with blood, the face becomes flushed, the eyes are reddened, the vessels throb, the pulse bounds. The heart's action visibly agitates the chest. The heat becomes now so excessive as to be far from agreeable, and associated with it is more or less violent, beating headache. The skin is dry and hot, the mouth is parched, there is great thirst. The secretions seem all dried up. In this condition of extreme distress the patient remains from two to four hours, when the heat begins gradually to subside. The attack is passing over now into the third stage, *the sweat*.

Perspiration presents itself at first about the chest, but extends gradually over the body. It is especially abundant about the neck and flexures of the joints; it stands out in beads at last, and, accumulating, trickles down upon the face. Gradually the extreme heat begins to abate. Under the evaporation of the excessive amount of fluid the surface cools, the head ceases to ache, the vessels to throb, the heart to bound. The sweating stage lasts again from half an hour to two hours. It is, as a rule, the shortest of the three stages of the disease. The patient now falls into comfortable

slumber, or is able, feeling somewhat languid or relaxed, to resume his occupation.

The scene repeats itself in twenty-four, forty-eight, or seventy-

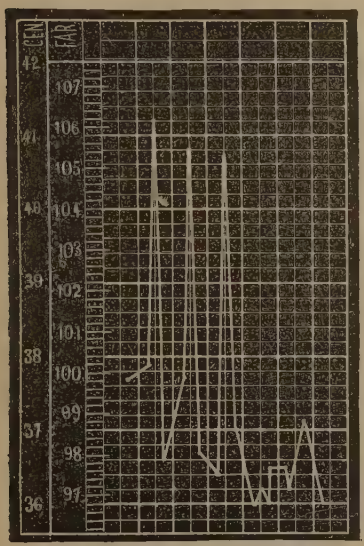


Fig. 157.—Quotidian fever (Seguin).

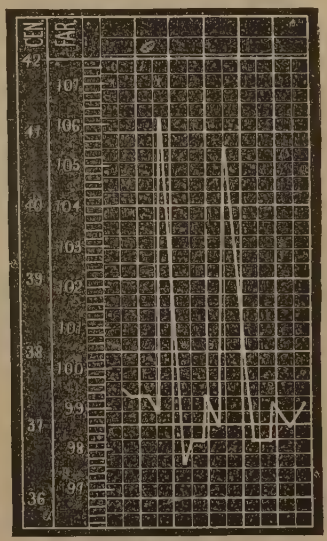


Fig. 158.—Tertian fever (Seguin).

two hours, to constitute quotidian, tertian, and quartan types of the disease. The tertian is by far the most frequent type. It is probable that the quotidian and quartan are modifications of the tertian type. The tertian type shows itself most frequently between the hours of 10 A.M. and 2 P.M., but may occur at any hour of the day or night. Attacks earlier or later than usual are said to anticipate, or postpone, forms, respectively, of increasing and decreasing severity. Double tertians and double quartans precipitate or otherwise disturb the regular order of events to such degree, at times, as to embarrass diagnosis.

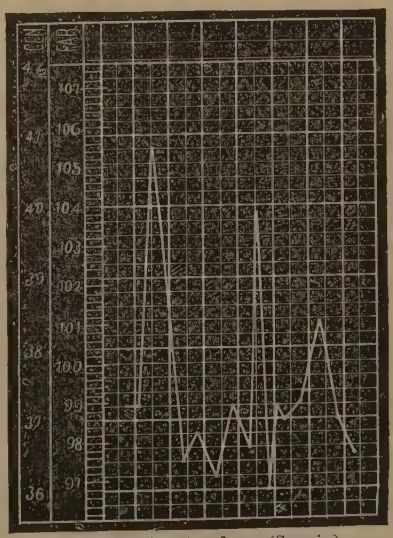


Fig. 159.—Quartan fever (Seguin).

In children an attack of intermittent fever varies in several points: 1. For the most part the chill is wanting. The child becomes drowsy or sleepy, dull; the surface becomes cold; the nose

and extremities may even become blue, but there is no convulsive agitation. In the majority of cases the attack is announced with the onset of the fever. The picture does not vary in fever from that of an adult, save that, 2, children easily suffer delirium and may become more or less comatose. 3. The sweating stage may be wanting entirely, or, if present, is never so abundant or long continued.

As the intermissions become less and less marked the disease finally presents the form of a *remittent fever*. Fever now never entirely abates throughout the whole course of the twenty-four hours, but there may be noticed during the early hours of the morning a more or less distinct remission of symptoms and fall of temperature of one to three degrees, with corresponding improvement in the subjective condition. In remittent fever the attack distinguishes itself by prominence of symptoms on the part of the digestive system. There is *gastro-intestinal*, more especially *duodenal catarrh*. The tongue is more or less heavily coated; there is more marked anorexia and nausea; vomiting is more persistent and troublesome. Many cases are marked by *jaundice;* the conjunctiva is tinted. The skin assumes a distinct yellowish hue. There is also pronounced constipation. These are the attacks that the old writers called *bilious fever*. As the disease becomes more and more continuous it comes to finally assume the picture of typhoid fever. There is, along with the gastric, more and more nervous depression, more and more stupor or headache, so that at times the diagnosis is not easily distinguished from that of typhoid fever. *Hæmaturia* is a complication which occasionally occurs in these cases. This accident is much more frequent in the more intensely malarious countries, but occurs occasionally everywhere. In the temperate zone hæmaturia should first excite the suspicion of malarial fever. As a rule it yields readily to quinia.

Masked malaria shows itself under a multitude of forms, the chief of which is *neuralgia*. Under whatever form, masked malaria is usually quotidian in type. The affection sets in in the earlier hours of the morning and ceases toward the close of the afternoon. The supra-orbital nerves are picked upon by special preference. *Supra-orbital neuralgia* is of malarial origin in the majority of cases. This is the brow ague, or, from its occurrence during the day and absence at night, the "sun pain" of old people. The *occipital nerves* rank second in the order of attack—pain in the back of the head, with the dull depression that distinguishes malarial poisonings. It sets in about 10 o'clock in the morning, to remain with the patient throughout the day. The *intercostal nerves* are attacked in the same way, to be distinguished at times from other intercostal neuralgia, or affection of deeper seated organs, only by the therapeutic test.

Sciatica has malarial origin rather as an exception, neuralgia of this nerve arising generally from other causes. Various paræsthesiæ, more rarely anæsthesiæ, may likewise depend upon malarial cause, and be recognized by periodicity of occurrence and rapid relief under the use of quinia. Malaria may also simulate pneumonia and pleurisy, affection of the kidney and bladder. There are malarial dysenteries and diarrhœas, malarial coryzas and catarrhs. There are cases of malarial hydrophobia and tetanus, night blindness, etc. Curiosities of all kinds may be found in the case books, dependent upon malaria as proven in the same way. It may be said that as the malarial poison becomes less and less intense, in cities, for instance, as distinguished from country places, the masked forms of malaria, which are the milder forms, predominate. The general rule holds good for all diseases or for any affection which shows more or less distinct periodicity of occurrence. It probably depends upon malarial cause. Thus dyspepsias and dysenteries which have defied all kinds of local treatment for months or years have yielded quickly and permanently to specific treatment. At the same time it must be admitted that the element of periodicity is not so distinct in our day as formerly. In the first place, the disease itself is milder. It may be assumed that less of the cause has been ingested or inhaled, or that in most cases the course of the disease has been interrupted or disturbed by treatment, so that the typical periodicity is not so easily elicited. But doubt alone justifies a trial of the therapeutic test. Of these cases it is said that the diagnosis is made *ex juvantibus*. Thus also it is made plain that many affections, especially neuralgias, of periodic occurrence or recurrence, are not necessarily malarial, are rather rheumatic in that they yield sooner to the salicylates than to quinine.

Pernicious malaria is that form in which either an enormous amount of the poison has been received into the body, or the body itself has been greatly debilitated in the course of the disease or by other maladies. Pernicious malaria shows itself, therefore, most in the unacclimatized, who are always peculiarly susceptible. It never occurs with the first, but shows itself in the second or third attack. It is announced with a chill, or with the second or third attack of quotidian, tertian, or quartan form, and presents itself also in variety of form. The most common is the *comatose form*, in which, under the chill, the patient falls into fever, stupor, and coma. The face is deeply flushed, the conjunctivæ congested ; the pupils, dilated or contracted, are irresponsive to light ; the cheeks flap in respiration ; there is stertorous breathing, general abolition of all sense, sensation, and motion, as in the picture of cerebral hæmorrhage.

A marked contrast to it is the so-called *algid form*, in which

there is profound collapse, feeble, fluttering pulse, cold surface covered with a clammy sweat, as in the picture of a protracted syncope.

Pernicious malaria is sometimes manifested also in the *convulsive form.* Fits, which closely resemble attacks of eclampsia, agitate the body, or assume at times the aspect of hydrophobia with its dread of water and terrible anxiety; or of tetanus, with fixation of the jaw, rigid contraction of the muscles of the body, sometimes with complete opisthotonos.

Malarial *cachexia* shows itself in individuals, long residents of a malarial climate, who have become to a degree acclimatized. In these cases the blood may be said to be saturated with malarial poison, to the degradation of the strength, physical and mental. These individuals show the picture, more or less pronounced, of marasmus. There is emaciation with the prostration; the complexion is sallow, the eyes sunken, the expression listless, apathetic. Perhaps the most marked bodily change to be discovered in these cases is distinct enlargement of the spleen, which, in the form of "ague cake," may be increased from five to fifteen times its natural size, to largely, or apparently entirely, fill up the abdominal cavity. These subjects are continual sufferers from irregular chills and fever, with headache, neuralgias, and the various masked forms of the disease. The poison which accumulates in the blood and spleen may manifest itself in almost any organ at any time.

The *diagnosis* rests upon the periodicity of attack, the intermissions or remissions (as determined by the thermometer in the hours of early morning), the enlargement of the spleen, and, in doubtful cases, the examination of the blood. Laveran found the parasite four hundred and thirty-two times in four hundred and eighty observations.

The *prognosis* has entirely changed for the better since the discovery of quinia—in fact, since the discovery of cinchona, in 1640, when the first specimen was brought to Spain from Peru by the Count of Cinchon, the Spanish Viceroy, and his body physician, Juan del Vego. Not much distinct progress was made, however, in the *treatment* of the disease until the time of Sydenham, who adopted the practice suggested by a druggist's clerk, Robert Talbor, of Cambridge, to dissolve the bark in alcohol (making a tincture, in other words), and administering the remedy close upon the heels of the previous, to prevent a future, attack. This treatment was perfected by the discovery of quinia by Pelletier, since which time the bark itself has been only rarely employed. All question of discussion regarding the treatment of malaria revolves now about dosage and time of administration. It is now common and the best prac-

tice to administer the remedy before the attack, and, as quinine has its maximum effect five hours after administration, it is given so that this effect shall coincide with the onset of the attack. An adult requires twenty-five to thirty grains, a child five to fifteen grains, to prevent attack. It is best given in pill, capsule, or wafer, and to children in powder with milk, in broken doses, taken in the course of half to one hour. Quinine is one of the remedies which may be given with nearly equal efficacy in the same doses per rectum. But quinine may fail, for two reasons—one, that the remedy may not be absorbed ; another, that after long use tolerance is begotten. These evils may be avoided by the administration of the remedy per rectum or subcutaneously. For such use the neutral bromide is to be preferred, as all acids irritate the skin. Care must be taken to keep the solution hot. The test tube, the spoon, and the syringe must all be kept warm, and the drug, in the ordinary dose of five grains to the maximum dose of ten grains, must be injected under the skin of the back deep into the subcutaneous tissues. Quinine may be used in this way in only the most exceptional cases, as, for instance, in pernicious malaria, where no time may be lost in addressing the cause of the disease.

The use of arsenic in malaria dates from the last century. It was first employed by charlatans under the name of "ague drops," and came into general use only when Fowler prepared a solution by which the quantity of the drug could be easily graduated and administered without danger. Arsenic is adapted especially to the cases of chronic malaria, malarial cachexia, and masked forms obstinate to quinia. The remedy is best given in the form of Fowler's solution, gtt. ij.–v. after each meal, to be increased daily to tolerance, as manifest in puffiness of the eyelids, pain in the bowels, or diarrhœa. Upon the occurrence of either of these signs the remedy is to be discontinued at once. Should it be deemed necessary to continue the dose in larger quantity, the pain and the diarrhœa may be prevented by the simultaneous use of a few drops of the tincture of opium.

Under the use of quinia and arsenic the protozoa which cause the disease disappear from the blood, but to secure permanent disappearance it is necessary that the remedy shall be continued in gradually diminished doses for at least a week after the subsidence of all symptoms.

As methylene blue has been observed to have the same effect upon the plasmodium malariæ, this remedy has been tried successfully by Guttman and Ehrlich. Doses of one to one and one-half grains of pure medicinal methylene blue, administered in capsule to prevent staining the mouth, every two hours for one or two days,

rid the blood of protozoa and break up the attacks of the disease. The remedy sometimes causes severe dysuria and has no advantage over quinia. Obstinate cases demand change of climate.

YELLOW FEVER.

Yellow fever ; Spanish, *vomito negro* (black vomit).—An acute infection of tropical coast towns, characterized by fever, which shows itself in stages of access, subsidence (stage of calm), and renewal (stage of reaction), icterus, albuminuria, hæmatemesis (black vomit), and rapid and profound prostration.

History, Geography, etc.—Yellow fever is indigenous in cer-

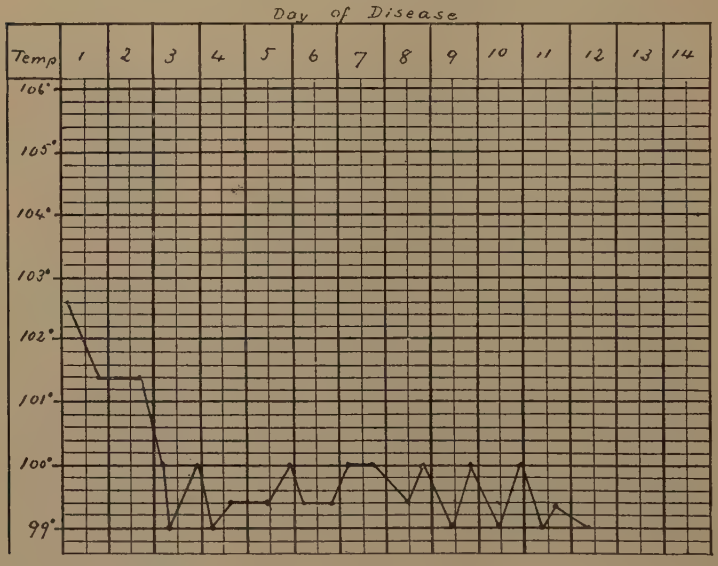


Fig. 160.—Temperature chart, yellow fever; mild case

tain parts of the tropics—West Africa, where it is believed to have originated ; West Indies (Antilles), first in 1647 ; Mexico in 1699—and is thence disseminated along lines of travel by sea to seaport towns or towns in direct (river) communication with the sea.

It is nowhere indigenous in our country, and dies out every winter on the advent of frost. Hence it must be freshly imported, unless infected matter be held over under favoring circumstances, as at Memphis, 1879, where it had hibernated from the previous year.

It reached the United States first at Boston in 1693, and has since occurred and prevailed at various places and periods—sometimes as a mild endemic, sometimes as a devastating epidemic—up to the present

time. Thus in Philadelphia in 1793, of 11,000 cases, 4,040 fell victims to the disease; in the epidemic of 1853 at New Orleans the mortality was 7,970, and in that of Memphis in 1873 the deaths numbered 2,000. The disease has been carried as far north as Portsmouth, New Hampshire (1798), and has penetrated to the interior by refugees as far as Cincinnati and Gallipolis (1887). The highest altitude (seven hundred and forty-five feet above the level of the sea) was reached at Chattanooga, Tennessee (1878). The famous College of Physicians of Philadelphia first (1797) promulgated the view that the disease is always of foreign origin and should be barred out by quarantine. The finest description of yellow fever was furnished by La

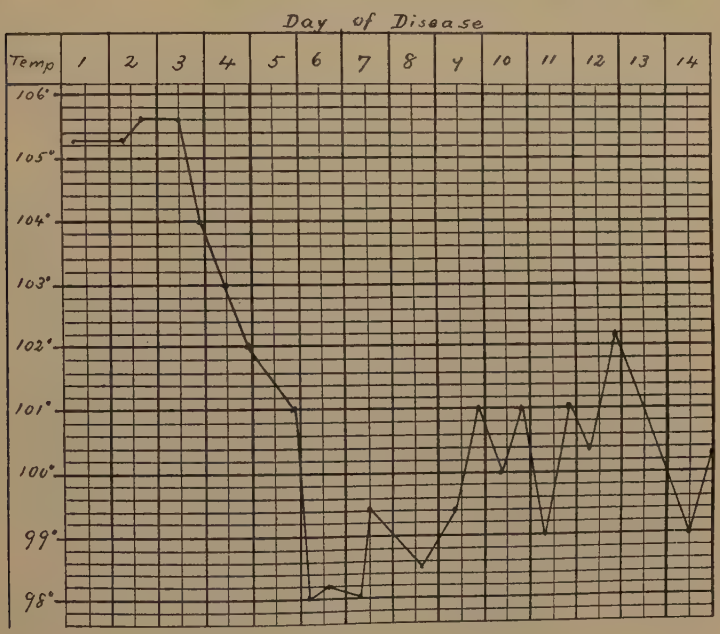


FIG. 161.—Temperature chart, yellow fever; typical severe case.

Roche, Philadelphia (1793); the most thorough studies of etiology by Sternberg, Surgeon U. S. A., Washington (1890).

Etiology.—Yellow fever comes only from without, and is presumptively caused by a micro-organism which, despite claims to the contrary, has not yet been isolated. The disease requires for development a certain temperature (75° F.) and moisture. It is not directly contagious, and is chiefly conveyed by things (fomites), especially by baggage and bedding of patients, and bilge water of ships carrying cases of the disease. The acclimatized have a degree of immunity which is lost by change of residence to regions never visited by

the disease. The colored races, Africans, creoles, have a certain immunity and lessened mortality. One attack confers immunity, as a rule.

Symptoms.—The *incubation* is short, from one to five days. This period is usually wholly free of symptoms. In exceptional cases malaise, anorexia, headache, vertigo, pain in the back, fatigue with tendency to sweat, may show themselves as prodromata.

As a rule the onset is sudden, with a *chill*, attended and followed by *fever*, *frontal headache*, and heavy rheumatic pains. *Pains in the loins and legs* may be excruciating in severity. The *face is flushed, the eyes shine* and are intolerant to light. "The dusky

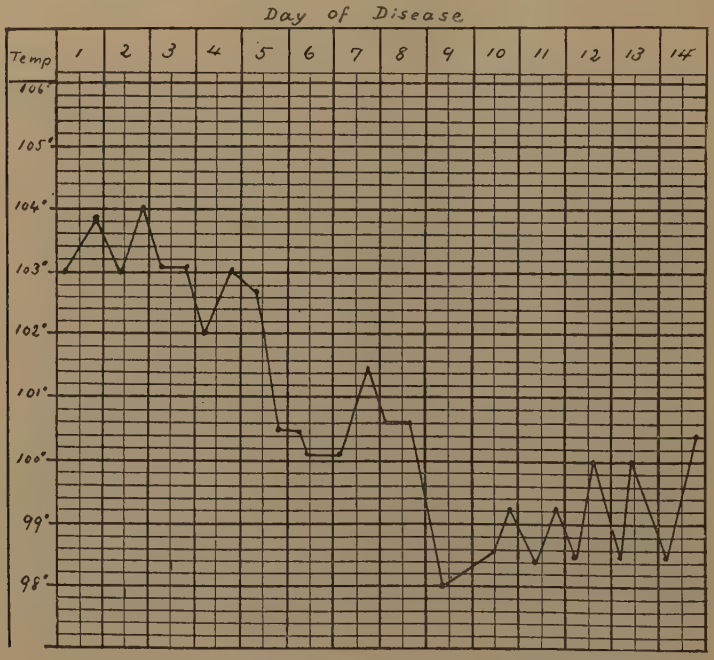


FIG. 162.—Temperature chart, yellow fever; protracted case.

face with the deep suffusion of the eyes in severe cases is quite characteristic" (Sternberg). The pulse, full and strong at first, is *reduced* in frequency and force, often *during the height of the fever*, and always in the stage of calm, when it may fall from 100–120 to 40–30 in the minute.

The cardinal symptoms of yellow fever are three—viz., the fever, the icterus, the vomit. These symptoms have given the name to the disease.

The *fever* is peculiar, in that it consists of but a single paroxysm

with a break in its gradual fall. The temperature is highest at the start and falls at once, and to such degree that the first few days only are considered febrile.

Hereupon ensues the *stage of calm,* a period nearly or quite free of fever, but marked by profound prostration. The stage of calm, like the stage of fever, lasts from a few hours to a few days, and is followed by the *reaction* with fever of remittent type. The accompanying charts (Figs. 160–162) from Sternberg's account record the run of the temperature in a mild, a protracted, and a severe case.

The *icterus,* which may be entirely absent, usually shows itself about the third day, and varies in degree from a faint yellowish tinge to a deep mahogany hue. When absent from the skin it may be still seen in the conjunctivæ, where it often makes striking con-

Fig. 163.—Liver cells in yellow fever with necrotic masses in and between the liver cells (Sternberg).

Fig. 164.—Streptococcus from vomit (not black) of yellow fever (Sternberg).

trasts in the colored race; in a fatal case it may show itself only post mortem. The icterus is due to rapid disorganization of the liver and reabsorption of bile. The symptoms largely revolve about the condition of the *liver,* which is found on autopsy to have suffered acute parenchymatous with fatty change without sensible atrophy. Products of this degeneration, as well as of the kidney, which shows the same process, poison the blood and produce in the last stages of the disease symptoms of *uræmia,* the *cholera typhoid with coma.*

Gastric distress, vomiting, as a sign of toxæmia, belongs to all the grave infections, but is especially frequent and severe in yellow fever. The *black vomit* is blood from hæmorrhage by diapedesis

through paretic vessel walls. It shows itself in the graver cases in the course of the first days, but is often entirely absent even in fatal cases of the disease. Hæmorrhage may occur also from other mucosæ, as from the mouth and nose (epistaxis), more rarely from the stomach, intestine, bladder, uterus, etc.

The *urine* is scanty and dark, in bad cases suppressed, and *always contains albumin* as one of the main features of the disease. The mind is usually clear but indifferent. Consciousness is maintained with apathy. Delirium is not common, though the scene usually closes with coma.

The *diagnosis* rests upon, 1, the existence of the disease in the community, or knowledge of its importation; 2, the albuminuria, which in its presence or abundance helps to distinguish yellow from remittent (malarial) fever; 3, the character of the fever with its stages; 4, the icterus; 5, the coffee-ground or black vomit. Yellow fever is distinguished from dengue by the fever (stages), as well as by the predominant or persistent pains of dengue, and from typhoid by the mental state, fever, and abdominal signs of typhoid fever.

The *prognosis* is always grave, and is based upon the intensity of individual signs, the amount of albuminuria, the degree of fever and of jaundice, etc. Black vomit is ominous, but is by no means of necessity fatal. The mortality ranges from ten per cent with the acclimatized, to eighty per cent with those not thus protected. Three-fourths of the deaths occur in the first week of the disease.

Prophylaxis consists in the quarantine of ships carrying cases of the disease. Land quarantine is useless. Camp life in healthy places is the best protection during prevalence of epidemics.

The *treatment* is symptomatic. It is considered good practice to open the bowels freely at the start with calomel or castor oil, but bad practice to continue purgation. Fever is best allayed by sponge baths and phenacetin gr. v.–x.; irritability of the stomach by cracked ice, bicarbonate of soda gr. x.–xx., best in soda or Selters water, or by chloral gr. ij.–v. in peppermint water.

To counteract the excessive acidity of the various secretions, Sternberg suggested the use of sublimate with the bicarbonate of soda as an alkaline antiseptic. After favorable reports from extensive trial, the combination was improved as follows:

℞ Sodii bicarbonatis..... ʒ iv.
Hydrargyri bichloridis..... .....gr. ss..
Aquæ puræ.....O ij.
M.

For a severe case two tablespoonfuls every hour, day and night; for a mild case, every hour by day and every two hours by night; administer always ice-cold.

CEREBRO-SPINAL MENINGITIS.

Cerebro-spinal meningitis (epidemic as distinct from simple and tubercular meningitis, *μῆνιγξ*, a membrane).—An acute infection, caused probably by various bacteria, commonly by a diplococcus, characterized by sudden onset, headache, opisthotonos, herpes, hyperæsthesia, and constipation.

History, Geography, etc.—Cerebro-spinal meningitis is a disease of modern origin or of modern recognition, for previous to the present century there was no possible differentiation of this disease and forms of typhus fever, pernicious malarial fever, tetanus, and the various inflammations of the brain and cord, diseases known to be as old as the history of medicine.

It is now conceded that it was first remarked as a separate disease in Geneva, February, 1805, by Vieusseux, who called the malady a *fièvre cérébrale ataxique*, and admitted that neither he nor his colleagues had ever seen a similar disease.

The next outbreak of the disease, with unmistakable signs, occurred in our own country, with the first cases at Medfield, Mass., in 1806. These cases formed the preface to a long chapter in the history of the disease, known then as "sinking typhus," ten years in duration, during which time it extended over, but remained confined to, the New England States.

Though doubtful cases prevailed before this time, cerebro-spinal meningitis belongs to the nineteenth century, and its history naturally falls into three periods, quite distinct, the first embracing the first cases of "ataxic cerebral fever," observed at Geneva in 1805, and of "spotted fever," in Massachusetts, in 1806; the second commencing with the outbreak at Bayonne in 1837, and extending over various parts of Europe and America up to the year 1866, gradually merging into the third or present period, when the disease has become nearly universal.

Cerebro-spinal meningitis belongs among the rarest of epidemic diseases. Since the establishment of the disease as a pandemic affection sporadic cases are of continual recurrence, but these cases remain isolated as a rule. The practitioner is often surprised at being confronted with a pronounced case of this disease in a crowded tenement house, in a palatial suburban residence, in a barrack or jail, in the ward of a hospital, in a distant farmhouse, when no similar case may have been reported, and probably no other case may show itself for years. Widespread epidemics constitute the great exception in the history of this disease, the outbreak at Dantzic in 1864–65 being the only notable example. So that individual cases, not distinctly marked, are apt to be overlooked for a time or erroneously

diagnosticated, and numerous instances are recorded in which the diagnosis has been fully established only upon autopsy.

Etiology.—Every attempt to connect cerebro-spinal meningitis with any special *climate* has turned out a signal failure. Equally futile has been the endeavor to fix the disease in connection with any special *soil*. But the *season* of the year has more to do with the development of this disease. Perhaps the most striking fact apparent in the study of the etiology of this affection is the frequency of its occurrence during the colder months of the year. Thus, of fifty-two epidemics in France and Switzerland, twenty-three occurred in winter, thirteen in winter and spring, and but two in the midst of summer; while of sixteen epidemics in our own country, six occurred in winter and five in winter and spring.

While it is acknowledged of cerebro-spinal meningitis that an almost freakish variation has occurred in its attack of individuals, it is generally conceded that it shows predilection for the period of *youth*. Thus it is stated by Hirsch that of 1,267 fatal cases in Sweden in the years 1855–60, where the age was stated, 889 were under fifteen years of age, 328 from sixteen to forty years, and 50 over forty years of age. Emminghaus makes the collective statement, from over fifty extensive observers, that of 1,435 cases 1,133 were under fifteen years of age. Smith, New York, found that of 975 cases 771 occurred in persons under fifteen years of age, and 336 in children under five years of age. In some epidemics *children* have been the only victims of the disease.

Individual epidemics have been frequently noticed to have been distinctly connected with different social states. The selection of *soldiers* as exclusive victims has made this disease a familiar guest in army life. The recent conscripts and new recruits have been often the sole victims of the disease. Pfeiffer says the disease "prefers winter, soldiers, and children."

A strict localization of the disease to certain houses, flats, or stories has often been observed. Prisons, workhouses, orphan asylums, constitute at times breeding places of cerebro-spinal meningitis. The epidemic in Ireland in 1846 was strictly confined to the prisons, and the disease broke out with the same seclusion in the orphan asylums in Philadelphia and Vienna in 1863, Washington in 1869, and Jerusalem in 1872.

One attack of cerebro-spinal meningitis confers future immunity.

Symptoms.—The disease begins with the aspect of a grave, acute infection. As a rule the onset is sudden, with the impress of profound toxæmia. A *chill* comes on in the midst of apparent health, with *vomiting, excruciating headache*, and rapid prostration. Tenderness and *stiffness in the back of the neck* supervene in the

course of a few hours. The face is pale, the expression anxious and strange, the extremities stiff and tremulous. The slightest motion intensifies the pain in the whole body; the act of vomiting makes it atrocious. A sense of formication with *hyperæsthesia* is felt first, as a rule, in the lower extremities, to which it may remain confined, or it may extend over the whole body. The special senses of sight and hearing become likewise supersensitive. A flare of light, the slam of a door, the rumble of wheels in the street, a touch of the bed, produce a condition of agony. Even the approach of an attendant with the gentlest ministrations is watched with apprehension. Temporary relief of this distress is secured during a state of sopor or stupor which may occur, from which the patient awakens or is aroused—children often with a *cri hydrocéphalique*—with a renewal of the same symptoms in greater or less degree.

In the course of a few days, often during the same day of attack,

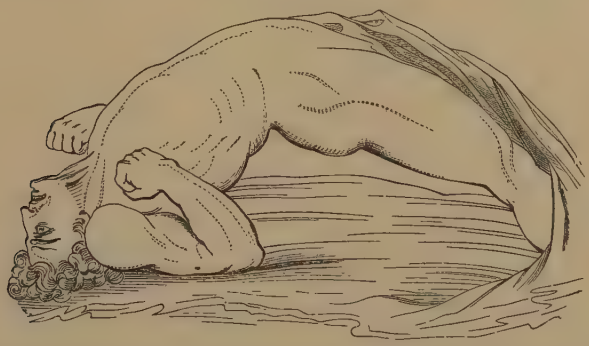


Fig. 165.—Extreme opisthotonos. From the original painting by Sir Charles Bell (Spence).

the stiffness of the neck increases to rigidity, or extends to constitute the characteristic *opisthotonos.*

Opisthotonos stands in the foreground in the semeiology of this disease. It is rare that some degree of rigidity in the back of the neck is not present, though Burdon Sanderson declares that in the Prussian epidemic, 1864–65, there were many cases in which there was no stiffness or retraction of the muscles. In the lightest cases there is simply a sense of increased resistance on attempts at flexion of the head upon the chest—a valuable point in differential diagnosis—or a slight degree of tenderness to pressure upon the cervical vertebræ. In most severe cases rigidity is marked, with retraction of the entire head, to such degree at times as to give rise to extreme mechanical dysphagia. Leyden speaks of cases in which the head was bent back at a right angle to the spine, and Gordon mentions an instance in which, in addition to this deformity, the spine presented

"a most wonderful uniform curve concave backward." The most striking illustration of the degree to which this extension may occur was reported by Neville Hart in a case in which the pressure of the occiput caused a slough between the scapulæ. In the experience of this author the degree of opisthotonos corresponded with the gravity of the disease. Not infrequently the rigidity extends lower in the vertebral column, as in Gordon's case just mentioned. Thus Jansen mentions an instance where the whole body could be lifted rigid with the hand behind the occiput, and Ziemssen and Merkel report cases of "orthotonos" in which attempts to flex the head pushed the body like a statue to the foot of the bed. With the other symptoms mentioned this condition may disappear, to reappear in greater or less degree, undergo fluctuations throughout the disease, continue to the fatal end—as long in one case as forty-nine days—or remain in some degree until full recovery. Ziemssen speaks of convalescents going about with rigid spines, and cases are reported in which the condition lasted throughout life. Usually the retraction is symmetrical, as pleurosthotonos is very rare. The rigidity is due to tonic contraction of the deep muscles of the neck, the splenii; the superficial muscles, the trapezii, remain unaffected. Convulsive twitchings of the face, or clonic spasms in the muscles of the extremities, may now occur, with delirium or outbursts of maniacal excitement under the slightest provocation. In the case of a young lady, under the observation of the author, clonic convulsions of the upper extremities existed continuously for three days and nights, and were only stilled finally by narcotic doses of opium. This patient escaped with life, but with lesions that left it of little value.

The skin shows the greatest variety of *eruption* of any one of the acute infections, with nothing peculiar or pathognomonic in any. A scarlatinous blush, more especially of the face, is very frequent in the first days of the disease, and a roseolar exanthem, more especially upon the trunk and extremities, frequently follows later. Hirsch speaks of spots resembling measles, Ziemssen mentions urticaria, Kamph erysipelatous maculæ, Grimshaw pemphigus, and Jenks bullæ, in individual cases. As to the petechiæ which have falsely named the disease, they are most frequently distinguished by their absence. Yet bloody eruptions or extravasations do occur in this disease as frequently as in any acute infectious malady of equal gravity.

The only eruption which has any real significance in meningitis is *herpes*. It begins usually as early as the third day of the disease, and may continue in renewed eruption throughout its course, or, as Hirsch remarks, weeks after full recovery. It shows itself first, as a rule, about the face, on the lips, nose, forehead, and neck, or may

extend to the chest, abdomen, back, nates, and even the extremities. Pneumonia is, perhaps, the only disease which shows herpes in equal frequency, but the herpes of meningitis differs from that of pneumonia in having no prognostic value. In fact, a renewed outbreak rather signifies an exacerbation of the disease.

The temperature curve of the disease distinguishes itself by its irregularity. As a rule it rises quickly at first to 102° F., or even 104° F., to fall in the course of a few days, or to undergo fluctuations in extreme degree, sinking at times below the normal. An extreme hyperpyrexia not infrequently precedes a fatal termination, which is usually attended, however, with a reduction to correspond with the marble coldness of the skin.

The pulse increases out of all proportion to the temperature, to experience, later on in the attack, greater fluctuation in frequency, volume, and tone than in almost any other disease. The same variations are noticed also in the acts of respiration, which are often quick and slow in the course of the same hour of the day.

The tongue is usually dry and red, in bad cases fissured and fuliginous, and sordes in these cases cover the teeth and gums.

The abdomen is sunken and retracted, often to such a degree as to show the outlines of the bodies of the vertebræ, or make distinctly apparent the crests and prominences of the iliac bones. Constipation is present, as a rule. The urine flows scantily and slowly from a paretic bladder, or in the worst cases is voided unconsciously in bed. Trismus, singultus, delirium, and coma, with ecchymoses and meteorism of the abdomen, mark the speedy advent of the close of the disease ; or relaxation of the opisthotonos, relief of the pain in the head, with critical sweats or enuresis, indicate a favorable resolution.

Of the symptoms produced by the local lesions, pain in the head is among the most prominent. *Headache*—crushing as if produced by a vise, or boring as from the penetration of nails or screws—is, as has been stated, one of the initial signs, and it constitutes always one of the most obstinate and distressing features of the disease. Fortunately it is subject to intermissions or remissions in the course of the disease, and not infrequently it disappears altogether. The other signs of the disease may then still remain in force, though cessation of headache may be usually regarded as one of the most favorable signs in prognosis. Warning should be entered here, however, against that ominous arrest of headache, along with a general euphora, which sometimes immediately precedes the end. *Vertigo* may be associated with the headache, to greatly aggravate the sufferings of the patient by compelling the continued observance of the recumbent posture.

Pain of a similar character, indescribable in its intensity, is also felt in other parts of the body, in the spinal column—*rhachialgia*—in the extremities, or anywhere upon the surface in the course of the spinal nerves. Usually such pain is paroxysmal, fulgurant, agonizing. It shoots out from the posterior nerve roots of the spinal cord, where the local lesion, as determined by gravity, is most intense, and carries with it sickening sensations of precordial depression.

A more characteristic, though less frequent, sign of cerebro-spinal meningitis is *hyperæsthesia* of the surface. It is commonly absent altogether in the lighter or abortive forms, and may not show itself throughout the short course of the foudroyant forms, but it is quite constant, at least in the earlier days of the disease, in cases of average intensity. It is first seen, as a rule, in the lower extremities, to which it may remain confined, next in the upper extremities, and lastly in the face and head. Like the pain, it may undergo remissions and exacerbations, may disappear to recur later, or may last over, in regions, to the period of convalescence. When present it adds a peculiar poignancy to the suffering of the patient, who watches with anxious eyes every movement about the room. In aggravated cases it is manifest also during sleep, and even the stupor of coma does not entirely annul it. In such cases it interferes with, or even entirely prevents, an examination of the patient, which, however, may be unnecessary, as, with the history and superficial inspection, it frequently declares the disease. It is often absent throughout the whole course of the malady.

The symptoms on the part of the digestive system belong among the cardinal manifestations of the disease, as *vomiting* ranks in significance along with the chill, headache, and opisthotonos. It is only the mildest cases which show no disturbance of the stomach. It ceases frequently in a few days, to reappear in bad cases, and to remain at times a more or less constant attendant of the disease.

Complications.—Cerebro-spinal meningitis is particularly prone to a number of grave *complications* and sequelæ, prominent among which may be mentioned paralysis and paresis of various organs and members, and profound, often permanent lesions of the eye and ear.

Among the most frequent and serious of the complications are *catarrhal* and *croupous pneumonia.* Of these affections catarrhal pneumonia, or broncho-pneumonia, is most frequently encountered in children, and, if developed as a secondary affection, readily undergoes favorable resolution. But croupous pneumonia has a much more serious prognosis. It occurs more frequently in certain epidemics—fifteen times in the Erlangen epidemic of 1866 to 1872—and develops by predilection in the later periods of the outbreak of the dis-

ease. Hyperæsthesia may eventuate in *anæsthesia* to such degree as to permit the penetration of a pin.

Of the special senses, besides that of touch, the senses of vision and hearing suffer most. Corresponding to the hyperæsthesia or hyperalgesia of the surface of the body is photophobia, to such degree, as a rule, as to necessitate the darkening of the chamber and the avoidance of artificial light. Graver lesions than this functional disturbance, conjunctivitis, iritis, irido-choroiditis, neuritis, atrophy of the optic nerve, even panophthalmitis, may occur in the course of the disease. The same exaltation of sensibility affects the ear with even greater distress, because offence in this regard is less preventable. Suppurative processes in the middle and internal ear, perforation of the membranes, atrophic changes, are among the graver affections of this organ as complications and sequelæ of this disease. So cerebro-spinal meningitis is one of the most common causes of deafness, perhaps the most common cause of all diseases affecting the internal ear. For in the vast majority of cases the affection is bilateral and permanent. Deaf-mutism most frequently results from this disease.

Forms.—Although different epidemics exhibit great variations in the degree and number of the symptoms cited, cerebro-spinal meningitis usually shows itself besides, in the typical cases mentioned, in one of three distinct forms or types—namely, the abortive, the intermittent, and the siderant or *foudroyant.*

The *abortive* form exhibits all its symptoms in the lightest grade. The headache is slight, the stiffness of the neck trivial or temporary, and vomiting may not occur, or may not recur after the first attack. Such cases often entirely escape recognition, or are diagnosticated only because of the prevalence of an epidemic of the disease.

The *intermittent* form is noticed more especially in certain epidemics, though such cases are wont to occur in any extensive outbreak of the disease. Not infrequently isolated sporadic cases assume this form, to the great embarrassment of the practitioner. Quotidian and tertian intermissions or remissions occur in all the symptoms of the disease, leading often for a time to erroneous prognostications. The intermissions are by no means as distinct, as a rule, as the periodicities of malarial disease, yet they prove exceedingly deceptive to superficial observation. The exacerbations correspond undoubtedly to the irregular invasions or advances of the cause of the disease.

The *foudroyant* is the fulminant form, in which the patient is often killed by the force of the poison before permanent local lesions have time to develop. These are the cases which destroy life in the course of from six to thirty-six hours. The patients in these cases are often suddenly stricken with unconsciousness and convulsions,

sometimes preceded for an hour or two with vomiting and pain in the head, in which condition they are carried home, pallid, cold, or slightly cyanotic, showing no reaction to the most powerful stimulants, to sink into coma and speedily succumb.

Morbid Anatomy.—The external appearance of the body in cerebro-spinal meningitis varies with the duration of the disease. Rapid or foudroyant cases exhibit no change, but cases of longer duration show an emaciation which in protracted illness simulates that of cancer and tuberculosis. No trace of eruption is discoverable, as a rule, though occasionally the surface remains covered with petechiæ. Suggillations form quickly and in quantity over the body, and post-mortem rigidity sets in soon. Moreover, decomposition begins unusually early in rapid cases, as in other acute infections. In the most chronic forms, with extreme emaciation, bed sores are common and extensive.

The muscular tissue is in the foudroyant cases brown and fragile, in cases of average duration more pale from loss of blood. The molecular change of fatty degeneration invades its structure, and gives it the appearance, which is especially remarked of the heart, of being strewn with sand.

The condition of the spleen varies greatly. It is usually found swollen in fulminant forms, with deeply darkened pulp, but not infrequently it is shrunk to such degree as to show a wrinkled capsule. In average cases it is rather the rule to find this organ of diminished size. As might have been expected, the intermittent forms show no enlargement of the spleen. The cloudy swelling, fatty and granular degeneration of the kidney and liver, ecchymotic state of the mucosæ, œdema of the lungs, effusions in the serous sacs, post-mortem softening of the stomach, swollen condition of the mesenteric glands, dark color and altered consistence of the blood, are changes which belong to all the acute infections and are especially marked in this disease.

The characteristic lesions are encountered at the anatomical seat of the disease, in the membranes of the brain and cord.

On opening the skull the membranes of the brain are revealed in a state of intense hyperæmia. The sinus longitudinalis is distended to tension of its walls, and all visible vessels are filled to their utmost capacity. In fulminant cases there may be no trace of exudation, but the pia mater is already opaque and lustreless, sometimes ecchymotic, from infiltration into its texture. The substance of the brain and cord is œdematous and softened in the most superficial layers.

In cases of longer duration the dura mater is stretched tense by the effusion beneath it, punctate hæmorrhages are diffused over its surface, and the hyperæmia involves the porous substance of the

bones of the spinal column, whose spongy structure appears saturated with blood. The pia mater is reddened with distended vessels, is opaque in some places, ecchymotic in others, and is softened in spots or more extensive surfaces. The first exudation is a light serum, which soon becomes an opaque milky fluid of semi-gelatinous or mucilaginous consistence, sticky, "drawing to a thread," which later becomes greenish, "leek-green," or yellowish with pus. It is effused first in the subarachnoid spaces and along the course of the vessels of the pia mater at the base and sides of the cerebrum, in the fissure of Sylvius and between the cerebrum and cerebellum, or extends over the whole surface of the brain to form a veritable cap. Or the exudation, more limited to the base, surrounds the emerging nerves, dissecting up their investing sheaths and following them out in their course. In the spinal column the exudation is deposited first along the posterior aspect of the cord, as determined by gravity, but soon extends to its lateral surface to affect or to follow out the spinal nerves in the same manner as in the brain. The thickest masses of exudation are found in the cervical and lumbar regions of the cord, though effusion in spots, bands, or islands occurs irregularly throughout its course. In its advance the suppurative process invades the sheath of the optic nerve, to travel along its course, infiltrate the orbital fat, to account in life for an iritis, choroiditis, or an all-destructive panophthalmitis. So, also, implication of and transit along the facial and auditory nerves lead to destructive changes in the ear.

A microscopic examination reveals the fact that the inflammation affects the tissues through the blood vessels. Numberless round cells infiltrate the intima and adventitia, to collect on the external surface and form the lines and layers of pus cells along their course.

Duration.—Cerebro-spinal meningitis has no definite duration. Hirsch says of it that it may last from a few hours to several months. The first period applies to the foudroyant cases, in which patients are killed as by a stroke; the last to the cases with complications or sequelæ, which may, indeed, prolong the disease indefinitely. Gordon's shortest case was five hours, and Jewell records a case of death in three hours and a half after seizure. These are, of course, most extreme and exceptional cases. Clymer states that more than one-half the deaths happen as early as from the second to the fifth day. This author quotes also from Parkes, who found the duration of the disease in sixty-six of ninety-five cases, five days or less; in one, eight days; in twenty-eight, eight days or over. Abortive forms terminate in resolution in from three to five days; foudroyant forms, with rare exceptions, in death within three days; and intermittent and average forms in one or the other way, barring complications and sequelæ, in from one to three weeks.

Diagnosis.—In the presence of an epidemic of the disease the diagnosis of cerebro-spinal meningitis is sufficiently easy. The existence of cases in the vicinity prepares the practitioner for new attacks. Cases which are affected with, or more especially quickly succumb to, any disease with predominant nervous symptoms should excite the suspicion of the physician in this direction. Sporadic cases, however isolated in space or time, are likewise readily recognized in the presence, in sufficient number, of the symptoms peculiar to the disease. The sudden seizure, often in the midst of health, with chill, vomiting, and prostration, followed by opisthotonos, hyperæsthesia, herpes, irregular pulse, constipation, constitute an array of symptoms that belong to no other disease. Unfortunately for the diagnosis, many cases deviate from the regular type in essential particulars, more especially in the absence of characteristic signs, to such degree as to make the diagnosis difficult or at times impossible. Foudroyant cases differ most widely by the predominance of the symptoms of blood poisoning which are common to all the grave acute affections. Light is sometimes thrown upon these cases by the consideration of the season of the year, the age of the patient, the existence of other cases more pronounced, or, if equally obscure, by the exclusion of simulating maladies or accidents. Thus a meningitis from trauma, syphilis, or otitis should be discovered by the history and inspection of a case; or occurring in the course of scarlatina, pneumonia, septicæmia, it should be eliminated by the presence of signs characteristic of these affections.

Typhoid fever distinguishes itself by the fact that it usually spares the period of earliest youth, that its onset is insidious, that it is attended with diarrhœa and distention of the abdomen, that it often shows a rose-color eruption, has a constant high pulse, a typical temperature curve, and a definite duration. Moreover, typhoid fever almost never shows herpes, and almost always shows enlargement of the spleen. Malarial fever is marked by its preference for certain regions and certain seasons of the year. Periodicity is the criterion of malaria, and, though this factor is simulated in the intermittent cases of meningitis, it is never so precise. Reeve says the early vomiting was the key to the diagnosis of his first cases of meningitis. Whatever doubt may exist at first is quickly dissipated by the administration of quinine in sufficient dose. Tetanus is eliminated by its trismus, and hydrophobia by its characteristic paroxysms of inspiratory spasm. Tubercular meningitis rarely shows symptoms on the part of the spinal cord, though opisthotonos and hyperæsthesia are not uncommon in this disease. Tubercular meningitis is nearly confined to childhood. In the great majority of cases its victims are of tuberculous parentage or stock. It is not affected by the season of

the year. It distinguishes itself especially by its long prodromal stage, by its periods of reduction of temperature and retardation of pulse, by the occasional signs of tuberculosis elsewhere, in the lungs or intestines, externally (scrofula) upon the skin, or possibly in the bottom of the eye.

Prognosis and Mortality.—The prognosis of this disease is always grave. The factor of most importance in its determination is the type of the disease. Foudroyant cases perish with very rare exceptions, abortive forms recover with but few exceptions, and average cases survive and succumb in about equal number. The character of the epidemic is the next consideration. Certain outbreaks are distinguished by their mildness, as are others by malignancy. Between these extremes is every grade of gravity in different attacks. It is also true of this, as of most of the acute affections, that the first cases are most severe. The epidemic grows feebler, as a rule, with the gradual exhaustion of its most fertile soil. Individual considerations follow next. The prognosis is more grave in infancy and childhood than in adolescence and maturity. The ratio of mortality falls from 75 per cent in children under one year of age to 53.5 per cent in later childhood and 35 per cent in adolescence. Of 15,632 cases analyzed by Hirsch, 5,734 terminated fatally. Thus the average ratio of mortality of this disease, under all conditions, is given at 37 per cent. The influence of "bad hygiene" in aggravating the prognosis is too patent to require mention. Of more importance are the signs which prognosticate the result in individual cases. It may be stated as a rule of this, as of all the acute infections, that a severe onset indicates a grave case. Thus a high fever at the start, obstinate vomiting, marked opisthotonos, early convulsions, are signs of ominous import. As one-half the deaths happen before the fifth day (Clymer), a case which survives the first week has a more favorable outlook. The first three or four days are attended with the greatest anxiety. "Every day passed after the seventh day renders recovery more and more probable" (Loomis). Typhoid symptoms at any stage of the disease imprint upon it an unfavorable prognosis. Arching of the great fontanelle, as indicative of intracranial œdema and exudation, is a very bad sign. Almost all such cases end fatally (Maurer). A return of headache and vertigo which has disappeared, especially if associated with vomiting and convulsions, evidences of consecutive hydrocephalus, is likewise ominous (Ziemssen). Yet secondary hydrocephalus is not absolutely hopeless, as Ziemssen saw "some cases in which a complete, and others in which an incomplete, recovery took place." Profuse sweats, with cold surface, are characteristic of a fatal issue (Hirsch). The persistence, after recovery from the disease, of anorexia, debility, and emaciation, perhaps with

diarrhœa, gives a poor outlook, especially for children (Emminghaus). A sudden high elevation of temperature, or hyperpyrexia, after a chill in a previously apyretic case, means a complication and not a fatal issue; but a hyperpyrexia without chill, and with a profuse sweat, is pre-agonic (Immermann).

Treatment.—A patient affected with this disease should lie upon a comfortable bed, not too hot, in a spacious, continuously ventilated room, whose windows can be darkened, if necessary, while they still admit the air, as remote from the street with its offensive sounds as may be. The temperature of the room should be regulated, with a thermometer near the head of the bed, at 65° F., by an open fire, preferably in a grate. The physician and the necessary attendants should be the sole visitors. Quiet should reign supreme. In no other disease is continuous or officious ministration so meddlesome and mischievous. Even cleanliness or apparent discomfort in posture must be sacrificed at times to peace of mind. The diet is to be simple and light at first, but as nutritious as possible with returning health. Beef tea palatably made, soups of any kind, milk if it do not increase constipation, scraped raw meat with a little salt, gruels if not distasteful, with water, Selters water, Apollinaris, any simple carbonated drink, should be proffered at proper intervals, without over-solicitation or any anxiety should everything be refused. With the beginning subsidence of the disease an egg may be dropped into the soup, or sweetbreads, fish, the white meat of fowl, may for a few days preface the more solid meats.

Especial attention is to be paid to the bladder. The soft catheter, thoroughly cleansed, warmed above the heat of the body and greased with pure vaseline, brings this organ, when refractory, under control. Constipation is overcome with calomel, two to ten grains, or castor oil, in preference to an enema, which causes too much disturbance.

The treatment proper is purely symptomatic and has reference to both sets of symptoms, general and local. Of these the symptoms produced by the local lesions—pain, opisthotonos, hyperæsthesia—assume prominence in the great majority of cases. For the relief of these symptoms no remedy equals in value opium. Opium is the "sheet anchor" in the treatment of cerebro-spinal meningitis. It acts solely by its anodyne influence. It protects, by obtunding, the nervous system until the force of the poison is spent. Surprising amounts of the drug may be given in this disease without narcotic effects. Thus Steiner often gave ten grains at a dose in cases of severe convulsions, without producing stupor; Chauffard, three to fifteen grains; and Boudin, seven to fifteen grains at first, and later one to two grains every hour, before soporific effects were produced.

Stillé was in the habit of prescribing one grain every hour in very severe, and every two hours in moderately severe, cases, without inducing even an approach to narcotism in any case. "Under the influence of the medicine the pain and spasms subsided, the skin grew warmer and the pulse fuller, and the entire condition of the patient more hopeful." When quick effects are to be had, or when the drug is rejected by the stomach, resort will be had, of course, to the hypodermatic use of morphia. Ziemssen gives expression to an experience made by every practitioner with this disease when he says that morphia is, without doubt, "indispensable" in its treatment.

Cold, in the form of bags of ice to the head or along the spine, is of great value when the period of excitability, hyperæsthesia, and jactitation may have given place to the state of sopor and indifference. Radcliffe claims that "the application of cold to the head and spine, either by means of ice or a freezing mixture in Esmarch's (or Chapman's) india-rubber bags, has furnished by far the most satisfactory results of all direct treatment."

Vomiting is best relieved by ice, champagne, effervescent drinks, milk and lime water, bismuth, soda, creosote, and chloral. No drug equals in efficacy, at times, sips of water excessively hot.

Hiccough is often brought under control by the same means prescribed for vomiting, by the administration of a few drops of the oil of cajuput, or by clysters of sodium bromide or chloral. More obstinate cases of either vomiting or singultus call for the subcutaneous use of morphine.

RHEUMATISM.

Rheumatism (ῥεῦμα, ῥέω, to flow), with the same derivation as catarrh; from the old Greek idea of a peccant humor circulating in the blood and instilled into the joints.—A term applied subsequently to all kinds of maladies thought to be due to exposure to cold, limited about the time of Ballonius (1600) to pains about the bones, joints, and other structures than mucous membranes, to which alone the term catarrh was confined. In our day catarrh is further limited to express those inflammations of mucous membranes which are not to be attributed to any special or specific cause, while rheumatism has yet much of the vague and diffuse meaning of ancient times. Thus the older writers spoke of visceral, gastric, cerebral, cardiac, vesical, etc., rheumatism; certain modern writers continue to describe cases of rheumatic pleurisy, peritonitis, etc., and the oculists still speak of rheumatic iritis in describing affections which are not to be attributed to a specific cause.

Pathology.—Rheumatism is, therefore, still a sort of refuge for maladies, especially affecting the bones or joints, whose real nature

is unknown. Sydenham separated gout, Senator arthritis, Zenker trichinosis. No less than five maladies are still considered under the head of rheumatism, but definite ideas cannot be had concerning any of them until each is distinctly isolated, if not as to its cause, at least as to its symptomatology. There is thus, first, acute articular rheumatism; second, chronic articular rheumatism; third, muscular rheumatism; fourth, gonorrhœal rheumatism; fifth, nodular rheumatism. These various affections must be separated from each other and from gout, syphilis, tuberculosis, rickets, or other affections of the bones and joints, before any clear understanding may be had of any one. It is probable that in the near future the term rheumatism will be confined to that acute articular variety which distinguishes itself by a more or less sudden onset with fever after the manner of an infection, inflammation of a number of joints with sweating, and liability to affection of the heart. This disease is commonly known as inflammatory rheumatism because of the acuteness and intensity of the inflammatory signs. The other diseases, until better defined, may be known as rheumatoid affections of the muscles, bones, or joints.

Acute Rheumatism occurs at all seasons of the year, but with preference for the fall and winter months, and thus more especially in connection with changing temperatures. It attacks particularly or almost exclusively the period of adolescence, from fifteen to thirty or thirty-five. Acute rheumatism in infancy or early childhood is almost unknown. Individuals with the widest opportunity for observation record isolated cases of rheumatism in the earlier weeks of life. Liability begins at four, begins to cease at forty, and is almost *nil* at fifty. Cases at or over fifty are survivals from earlier periods. It seizes by preference the poorer or working class, that most exposed to changes of weather, but picks especially upon certain individuals who seem to possess for it a natural predisposition. What constitutes this susceptibility is unknown. These individuals suffer, not one, but repeated attacks, for rheumatism is a disease to which the individual, originally so to some extent, becomes more susceptible after each attack.

Rheumatism is commonly ascribed to taking cold, though there is no more satisfactory explanation of the relation between cause and effect in this than in any other disease said to be due to the same cause. The older writers spoke of rheumatism as a neurosis. Impressions made upon the skin were conveyed through the nerves to be reflected to the joints. The impression of cold was said to seize upon the joint as a *locus minoris resistentiæ*—an explanation which is only a paraphrase.

Froriep and Canstatt invoked a toxic theory in ascribing rheuma-

tism to the accumulation or to the excess of lactic acid in the blood, and some support seemed to be lent to this view through the fact that the administration of lactic acid in large doses, as in the treatment of diabetes, produced in some cases inflammation of the joints. This view, however, lacks the important support of the discovery or detection of any excess of lactic acid in the blood. The tendency in our day is to regard rheumatism as an infection or mycosis, based upon the facts (1) of the nature of its onset and course; (2) of the occurrence of the disease undeniably in the course of certain infections, as scarlet fever, dysentery, puerperal fever; (3) that the remedy which has over it almost specific control—salicylic acid—is a powerful antimycotic remedy. But this view lacks also the all-important evidence, or at least sufficient evidence, of the discovery of any particular micro-organism in the blood or organs affected by the disease. Buday (1892) found that the injection of the Streptococcus pyogenes into the jugular vein of the rabbit was followed by inflammation of the joints. In six fatal cases of acute rheumatism in man pyogenic micro-organisms were found in the joints, as they are in the fluid of all cases examined. They are discharged into the joint by the rupture of metastatic (capillary) emboli.

Symptoms.—Rheumatism begins with a *chill*, or series of shivering fits, attended and followed by *rise of temperature* to 102°–105° F., in the course of the first twelve to twenty-four hours. There is at this time the malaise and distress which belong to fever, though there is not, as a rule, the same anorexia, nausea, or nervous disturbance that belong to most of the acute infections. Rheumatism, in fact, distinguishes itself rather by the absence of these signs in its inception. The nature of the disease is proclaimed in the course of the first twelve to twenty-four hours by the *affection of the joints.* The rule is that the medium-sized joints are affected first: thus the knee and the ankle and the wrist, and afterward the shoulder and elbow, then, some time after, in the order of frequency, the fingers and the joints of the vertebræ.

In bad cases unusual joints are affected, as the joints of the jaw, of the larynx, of the symphyses, of the ribs, so that in an extreme case the patient lies paralyzed as to motion, on account of pain, which is perceived all the more acutely because of the clearness of the sensorium. The affection of the joints announces itself also by the inhibition of motion. The limbs are held in the semi-flexed position to avoid tension, and as absolutely immobile as may be. Every agitation of the room, more especially of the bed, increases the pain, which shoots through the joints like the stab of a knife and dies away only gradually under perfect rest.

The medium-sized and smaller joints show inflammation by

swelling or redness as the synovial fluid is increased to cause distention of the capsule of the joint. Sometimes the skin over the joint pits upon pressure from a subcutaneous œdema. Spots or strips of redness are to be seen over the larger joints. Sometimes a sheet of crimson red announces the intensity of the inflammation beneath. In cases of the largest joints, as the hip or the shoulder, there may be no external discoloration, on account of the depth of the disease.

What especially characterizes this form of rheumatism is the *fugacity* of the affection. It attacks a joint severely, so that it remains inflamed intensely for a few days, whereupon it disappears to attack another joint or joints. Rheumatism is said to fly from joint to joint. Sometimes it returns to the joint first affected, and thus projects itself over a long period of time. But, notwithstanding the intensity of the inflammation, as manifested by the swelling, redness, and pain, the disease disappears when it subsides, to leave no trace. There is in rheumatism a *restitutio ad integrum.* Should suppuration occur, or should the joint be left anchylosed, it is a case of mixed infection. Pure rheumatism shows no pus and leaves no deformity in the joints.

A prominent symptom in the course of rheumatism is *sweating*, which is ordinarily so profuse as to saturate the garments and the bed linen. The perspiration has an acid reaction and an intensely sour odor. But the evaporation of this large amount of fluid has little or no effect upon the temperature. Where ablutions are not frequently practised sudamina form, and may be seen as glistening vesicles, sometimes over the whole surface of the body.

The grave *complication* of rheumatism occurs in the *heart.* In a certain percentage of cases either pericarditis, endocarditis, or myocarditis occurs in the course of rheumatism. This complication does not occur always in correspondence with the severity of the fever or the number of joints affected; involvement of joints near the heart has nothing to do with its production. Thus an affection of the foot would be as likely to be attended by heart disease as an affection of the costo-chondral joints. The heart is affected more especially in the young. The patient between fifteen and twenty-five is most liable to suffer heart complication. Attacks in later life are generally free from heart disease.

Authorities differ as to the frequency of this complication. Bouillaud believed that all cases had heart disease—regarded rheumatism, in fact, as the effect of the heart disease, or described the heart disease as one of the joints affected. Wells believed that heart complications occurred in about one-third of the cases. Sibson and Fagge put their estimate at about fifty per cent—a ratio which represents the modern belief.

Heart disease reveals itself most frequently by a *precordial pain, palpitation, and dyspnœa;* often, however, by none of these signs, so that the condition is discovered only by careful examination of the heart, whereby a bruit is elicited or enlargement of the diameters recognized. Many cases recover from heart disease, but in more, permanent lesion is left. The heart is crippled for life.

Rheumatism is sometimes marked by excessively high temperatures—*hyperperexia*, 110° to 118° F. These sudden elevations occur in the course of the rheumatism. The disease does not begin in this way. This complication is recognized also by *grave cerebral signs*—delirium, convulsions, and coma. Most of these cases terminate fatally.

Diagnosis.—Acute rheumatism is to be separated from *pyæmia*, if it be not itself a mild pyæmia. There is in pyæmia usually a history of an abscess or of a trauma. There is recurrence of chills and a more regular temperature curve, evidences of emboli elsewhere as well as in the joints, a protraction of the disease over a longer time when not cut short by some grave complication, and an inamenability to treatment. Rheumatism has in itself no special mortality, except in the few cases of hyperpyrexia.

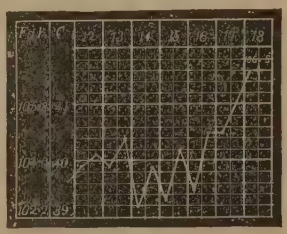


Fig. 166.—Hyperpyrexia of acute rheumatism.

Aside from heart complications, rheumatism has a *mortality* of about three per cent, so that the disease is more dreaded from its complications than from its own character.

The *treatment* of rheumatism has been resolved in our day to the administration of salicin or the salicylates, which are looked upon as specifics. The treatment by alkalies, by acids, by blisters has fallen into disrepute in the presence of the salicylates. Clinical observation has shown that when a certain number of cases in a ward are treated by each of these methods, there is no appreciable difference between them and cases treated without any remedies, as to duration, complication, or mortality.

Stricker, in 1876, called attention to the virtues of salicylic acid in the treatment of this disease, and Maclagan, of Dundee, announced in this year that he had employed salicin as a specific since 1874. The fact has since been unearthed that the Boers of South Africa were accustomed to administer to patients affected with rheumatism teas made from the willow bark. Scepticism and incredulity have completely disappeared under the test of observation and experiment. It was soon seen that the remedy possessed the virtues ascribed to it by the discoverers or first observers—that the salicy-

lates cut the disease short, and, by abbreviating it, lessened in this way, and only in this way, complications on the part of the heart and acute pyrexias. The form of the remedy most in use in our day is the salicylate of soda. The following is a convenient recipe for quick effects :

℞ Sodii salicylatis..... ℥ ij.
Glycerinæ..... ℥ i.
Aquæ menthæ piperitæ..... ℥ iij.
M. S. Dessertspoonful to a tablespoonful every two to four hours.

Equally efficacious is salicylic acid or salol, in powder or capsule, gr. v.–x. every hour or two. Obstinate cases require change of form.

In a pronounced case with much suffering it is justifiable to administer a dose of morphia subcutaneously, to be followed up immediately with salicylates, gr. vijss.–x. every hour at first, later every two hours. So soon as the pains lessen or the remedy produces any toxic effects, as nausea, ringing of the ears, vertigo, headache, the interval is to be increased or the dose diminished or the remedy stopped. Salol is contra-indicated in the presence of any suspicion of kidney disease.

Pain usually yields in the course of five hours, and swelling begins to subside on the following day. The average duration of the disease under this treatment is about five days—a great gain over the six weeks at the time of Cullen.

The best external treatment is fixation of the joint by pillows or bags of sand and the application to the surface of cloths wrung out of hot water. Cases marked by hyperpyrexia call imperatively for the cold bath. Apparently desperate cases have been thus rescued, as by Da Costa from a temperature of 106° F., by Draper and Maynard from 107.4° F., and by Fox from 108.4° F. Masses of ice were applied freely to the chest and abdomen in these cases, and brandy was given in abundance.

Chronic Rheumatism.—Chronic rheumatism is a different affection. It is true that occasionally chronic results from acute rheumatism, more especially in those cases in which acute rheumatism repeats itself often in the same joint, until there is at last left an irritation which remains. It is, however, only the exceptional case of acute rheumatism which becomes chronic. In the rule chronic rheumatism begins as such, and distinguishes itself by remaining a *local* affection. Chronic rheumatism belongs to the *last half of life*, whereas acute rheumatism begins in adolescence and begins to diminish at maturity. Chronic rheumatism begins at maturity and increases with advancing age. Chronic rheumatism is also, for the most part, a disease of the poorer class; when occurring among the

better class it may be attributed to local and, for the most part, discoverable conditions. Chronic rheumatism confines itself to one or a few joints, where it remains for months, for years, or for life. Chronic rheumatism is *monarticular or oligarticular* in distinction from acute rheumatism, which is polyarticular. Acute rheumatism is said to fly from joint to joint. Chronic rheumatism *remains fixed* in one or a few joints.

Pathology.—Continued exposure to cold is cited as the most frequent cause of this affection, and the exposed joints are the joints affected. Thus washerwomen are affected in the wrists, maid servants in the ankles, scrubwomen in the knees, coachmen in the wrists, porters in the feet, etc. The continued exposure of a side of the body, as by the apposition of the bed to a damp wall, or of the knees in writing at a desk, or feet as in riding, are frequent causes of this affection, which may disappear with removal of the cause. The pain in chronic rheumatism is not so acute or intense; it is rather subacute, and distinguishes itself by its protraction rather than intensity. Dull, boring, grinding, aching pains are the characteristics of chronic rheumatism, subject at times to more or less acute exacerbation. Chronic rheumatism shows itself in a more or less fluctuating course, with relief of pain in warm or dry weather, increase or aggravation in raw or damp weather. Acute pains supervening in the course of chronic rheumatism show complication with the acute form of the disease. Chronic rheumatism, pure and simple, is unattended with any sweating or complication on the part of the heart.

Long-standing cases, especially under bad hygiene, show more or less *permanent change.* The effusion, which may be very extensive, persists. The tendons about and membranes in the joint become more or less thickened and opaque. Various anchyloses show themselves, but in the vast majority of cases there is no alteration of bone or cartilage to such degree as to produce organic deformity. Deformities of chronic rheumatism disappear or may be dissipated by massage, forcible extension, etc., especially under chloroform. The disease affects chiefly the *larger joints,* hip and shoulder and knee, wrist and ankle. Affection of the smaller joints implies for the most part a different disease—gout, nodular rheumatism, etc.

Diagnosis.—Chronic distinguishes itself from acute rheumatism by the fact that it occurs in the latter half of life, mostly in old people; that it affects a single or a few joints, to which it remains confined; that it persists in spite of medication; that it is unattended by sweating, heart complication, or high fever.

The *prognosis* quoad vitam is good; quoad valetudinem is bad. Few diseases which are not in themselves fatal or involve organic change are so obstinate to treatment. Chronic rheumatism is for

the most part a disease of life. The hopelessness of any radical therapy is evidenced by the number of remedies recommended in its relief. Chronic rheumatism is, in fact, a fertile field for quacks, and every age abounds in plasters, liniments, and oils, in appeal to the credulity of the people, and in such profuseness of advertisement with us as to deform the face of nature.

Treatment.—For the acute attacks of pain or exacerbations of inflammation the best remedy is salicylic acid, the salicylates, salol. For the chronic states the best remedy is the iodide of potassium. Most patients are more or less debilitated by age if not by the disease, so that alcohol, cod-liver oil, iron, quinine, hypophosphites are indicated in different cases. The virtues of local application depend upon *heat* and *friction.* Heat in the acute exacerbations is best applied with cloths wrung out of hot water, with poultices, hot water bags, etc. Fixation of the joint in these cases is of value, as by sand bags, pillows, splints, bandages. Such fixation, however, is not to be retained long enough to allow of anchylosis or atrophy from disuse. Hot-water baths at home or, better, at watering places, sand baths, peat baths, mud baths, are various applications of heat. Blisters in the neighborhood of the joints are the best derivatives, especially flying blisters—*i.e.*, repeated in the vicinity of the joint—after the manner of the former treatment of acute rheumatism. Blisters derive materials which, reabsorbed into the blood, officiate as protective albumens, so that there is something more in blisters than mere counter-irritation. Liniments, sal-volatile liniment, opodeldoc, compound soap liniment, more especially applications containing chloroform, opium, aconite, are stimulating embrocations.

℞ Tincturæ opii,
Tincturæ aconiti ..... āā ʒ ss.
Chloroformi ..... ʒ i.
Olei olivæ ..... ʒ ij.

Or

℞ Olei gaultheriæ,
Olei olivæ sive morrhuæ ..... āā ʒ i.

applied with friction, are good combinations. Arnica should be avoided, because it produces at times an obstinate eczema.

A victim of chronic rheumatism, when able, should travel, should find a suitable climate in Georgia, the Carolinas, Florida, Nassau, the Bermudas, California, etc.

Gonorrhœal Rheumatism.—Gonorrhœal rheumatism is a separate form which has points in common with both acute and chronic, and points by which it may be separated from either. Thus it attacks for the most part the age of adolescence or maturity,

males four times more frequently than females, and is confined to a single or a few joints. The disease distinguishes itself by its subacute character. It occurs for the most part six to twelve weeks after the original infection, and persists for months, sometimes for years. When first observed it was thought to be a mere coincidence; but the frequency of its occurrence, more especially the continued recurrence in certain individuals, establishes it as a complication.

It is as yet undecided whether gonorrhœal rheumatism depends upon the gonococcus or upon pyogenic organisms of subsequent, *i.e.*, secondary, infection or invasion.

The disease fixes itself for the most part upon the knee, ankle, or joints of the foot. These joints become swollen, sométimes immensely swollen, without any acute pain because of the tolerance which is established under a slow development. Gonorrhœal rheumatism, like chronic rheumatism, shows no sweating, has no cardiac complication, and leaves no deformity. Unlike chronic rheumatism, when finally cured it ceases, never to return, unless through new infection.

The *treatment* does not differ radically from that already detailed. The constant current of electricity furnishes better results in gonorrhœal than in other chronic rheumatism. The sluggish character of the ailment calls for this stimulus, as well as that furnished by friction, massage, etc. The chronic gonorrhœa, gleet, or posterior urethritis, which may persist as a cause of continuous infection, should be treated until every trace of it disappears.

Muscular Rheumatism. *Pathology.*—Muscular rheumatism is another of the varied forms of affection included under the term "rheumatism" as evidence of the vagueness and elasticity of the term itself. For muscular rheumatism confined to the muscles has nothing to do with the bones or with the joints, and the disease is called rheumatism only because it is marked by pain. Muscular rheumatism occurs at any time of life, but is noticed in certain forms, or particularly at certain periods of life. Thus affection of the cervical muscles belongs more particularly to youth ; of the intercostal muscles, to maturity ; of the lumbar muscles, to age. In many cases muscular rheumatism is simply the effect of trauma, whereby muscular fibres are ruptured. This is the case especially in the sudden attacks of lumbago commonly known as stitches in the loins or back (*Hexenschuss*). The same thing is true also of many cases of intercostal muscular rheumatism, so-called pleurodynias. Sudden tensions, sudden wrenches, rupture individual fibrils and fibres. Other forms of the disease seem more directly attributable to exposure to cold. Thus torticollis, or rheumatism of deeper-seated muscles of the neck, may arise from sleeping opposite an open window

in a draught or sitting at an open car window in travelling. In many cases it may be assumed that poisons in the blood, micro-organisms or their products, hitherto innocuous, have become localized in individual muscles or their nerve centres by irritation or exposure. Such cases therefore may be said to be of infectious origin.

A fine example of this muscular rheumatism is offered in trichinosis, which was formerly regarded as a kind of malignant rheumatism. Grawitz declares that in ninety per cent of cases of aggravated muscular rheumatism, so considered, he found on autopsy trichinæ in the structure of the muscle.

It may be readily understood that trichinæ may be ingested in sufficient number to produce light or more or less severe muscular

Fig. 167.—Torticollis (Gowers).

rheumatism without previous or subsequent sign of their presence, and this origin may be assumed to exist all the more for the reason that the muscles affected—to wit, of the neck, of the chest, of the loins—are precisely the muscles most frequently invaded by trichinæ.

Morbid anatomy shows at times hyperæmia, opacities of the sarcolemma, coagulations in muscular protoplasm, etc.; but in most cases no lesion is to be found under the most careful inspection, and, inasmuch as the disease disappears to leave no trace, it must be believed that in most cases no real lesion exists.

Symptoms.—Muscular rheumatism manifests itself chiefly in pain, spasm, in interference or abolition of motion, sometimes in distortion.

Occipito-frontal rheumatism is felt on motion of the scalp, and is distinguished from occipital and frontal neuralgia by the fact that

in neuralgia tender points can be located in the course of the occipital and trigeminal nerves.

Torticollis (cervical rheumatism) shows itself in twisting of the head to one or the other side. It must be distinguished from affection of the vertebræ or deep-seated neuralgias due to lesions in the spinal cord, from which affections it is, as a rule, readily separated by its more or less sudden origin, acute pain, short duration, and entire disappearance.

Pleurodynia is distinguished from intercostal neuralgia by the absence of the tender points near the spine, in the axillary line, and near the sternum, to be discovered by pressure in neuralgia.

Lumbago is the most common form of all. There is pain on motion, especially aggravated in rising from a sitting posture or from bed after a night's rest. In a bad case the whole body is literally paralyzed by pain, and patients, more especially obese patients, lie helpless on the bed.

The *diagnosis* must be established at the start. An acute infection must be eliminated. Thus, small-pox distinguishes itself by the severity of its pain in the loins and sometimes the back of the head. Tuberculosis, aneurism, caries of bone, tumors, need only be mentioned to be separated. A protracted lumbago in a young person should always excite suspicion of caries of the spine, Pott's disease, which may reveal itself in a gibbus or in rigidity of the muscles of the spine. A very early diagnosis may be made with tuberculin.

The *prognosis* is good not only as regards the general health, but also the condition of the muscle, which is usually restored to the *status in quo*.

The *treatment* is simple. Applications of heat and friction are the essential elements. Dry is better than moist heat. Hot-water bags, hot flannels, cloths over which a hot iron is passed, are domestic remedies. Dry cups often give quick relief. Excruciating pains, pains which prevent all motion, are best counteracted by deep injections of morphia, gr. $\frac{1}{8}$–$\frac{1}{4}$. Sometimes a subcutaneous injection, or the internal administration of phenacetin or antipyrin, gr. v., suffices. Friction with liniments, massage with alcohol, ointments of vaselin or lanolin, incorporating perhaps opium or aconite, according to formulæ suggested, relieve the pain in most cases. More permanent relief is often afforded by faradization with a wire brush, with a roller, or with simple sponges, or by galvanization when the former fails.

DYSENTERY.

Dysentery (*δύς ἔντερος*, difficultas intestinorum); flux; German, *Ruhr*.—An infection of the large intestine, of specific and non-

specific (catarrhal) origin and form; characterized by hyperæmia, infiltration, and necrosis (ulceration) of its mucous membrane; distinguished by discharges of mucus, blood, pus, and tissue débris; and attended with griping and expulsive pains (tormina and tenesmus).

History.—Dysentery is one of the oldest known diseases. The Ayur-Veda of India mentions forms of it, Hippocrates described it, and Herodotus relates how this disease and the plague decimated the army of Xerxes on the desert plains of Thessaly. Galen derived the discharges from the bile, Aretæus wrote graphic accounts of the symptoms. The disease assumes epidemic proportion only in hot climates, and rages as a pestilence in army life, where it numbers more victims than the bullets of the foe. The accounts of this and allied disease, and the illustrations of its lesions, in the "Medical and Surgical History of the War of the Rebellion," vol. ii., make a lasting monument to the labor and learning of the editor, Joseph J. Woodward, of the United States Army.

Etiology.—Dysentery is only a clinical expression, and the disease is due to many causes. The most fruitful cause is drinking water contaminated by the discharges of dysenteric patients or perhaps by any decomposing matter. Exposure to cold, bad food, through nervous influence and by direct irritation of the mucous membrane, may produce individual cases of the catarrhal form. The disease is certainly intensified by crowd-poisoning, as in army life, pilgrimages, etc.

Bacteriology.—Many micro-organisms are found in the discharges of dysentery. Two have been isolated as probable causes of the disease. One is the Amœba dysenteriæ, the other a bacillus. Kartulis (1892) especially makes emphatic claim for an amœboid body which he finds constantly in the discharges, and which has been found also in the contents of hepatic abscess. Kartulis cultivated the amœba in decoctions of straw, and inoculated it to produce certain symptoms of the disease. Lambl and Lösch had remarked this structure previously, but had not ascribed to it pathogenetic property. Councilman and Lafleur of Baltimore, and Musser of Philadelphia, confirm in part the claim of Kartulis; and Lutz of Honolulu probably defined the exact position of the amœba as the cause of only certain individual (catarrhal) cases, but not of the epidemic disease, which is more probably produced by a vegetable structure (vide Frontispiece, Fig. 17). The other is the bacillus described more especially by Ogata as the definite cause of an epidemic in Japan. This bacillus, isolated and cultivated, produces, when introduced with the food or injected into the bowel of various animals, ulcers and hæmorrhages in the colon, swelling of the mesenteric glands, and nodular masses in the liver and spleen.

Symptoms.—Dysentery is a disease of the large intestine only, but it is usually gradually ushered in from a lighter form of gastro-intestinal catarrh. After a stage of incubation, which lasts from a few hours to a few days, symptoms of *dyspepsia* and *diarrhœa* set in or increase, attended with anorexia, heartburn, nausea, eructation or borborygmi, pain in the abdomen, and copious fluid discharges. Hereupon ensue the *pains* and *discharges* characteristic of the disease. Violent griping and colicky pains (tormina) traverse the abdomen, with sickening sensations of depression. The desire of evacuation of the bowels (tenesmus) becomes intense and more or less constant, and the discharge itself is attended with little or no relief. At the same time the region of the rectum, intensely inflamed, is the seat of intolerable, burning pain, which becomes excruciating with the introduction of a speculum or the finger.

Ordinarily the peculiar *pains* of dysentery first proclaim the character of the disease. The severe grinding, twisting pains (tormina) are more or less localized in the course of the colon, and hence surround or traverse the entire abdomen, the pains at the epigastrium being due to spasmodic contractions of the transverse colon. The patient in vain adopts various postures in relief, or sits with his hands firmly compressing the abdominal walls. The tormina are more or less intermittent or remittent, and are usually experienced in greater severity toward evening. During their acme the face wears the aspect of the intense suffering, which is expressed in outcries and groans. At the same time there is, upon pressure over the whole abdomen, more or less tenderness, which soon comes to be especially localized at the cæcum or sigmoid flexure.

The tenesmus (cupiditas egerendi) is a more distressing, and certainly more distinctive, sign of dysentery. It is the feeling of heavy weight or oppression, of the presence of a foreign body in the rectum, which demands instant relief. At the same time intense heat is felt in the rectum, which the patient likens sometimes to the passage of a red-hot iron. The desire of evacuation becomes as frequent as urgent. In well-marked cases the patient sits at stool half an hour or an hour at a time, straining until faint and exhausted, leaving the commode with reluctance, only immediately or very soon to use it again.

Great depression is felt at the stomach at the same time, with nausea, occasionally with vomiting; and strangury, with the discharge of only a few drops of scalding urine or blood from the bladder, adds additional suffering to the disease. Retraction of the testicle and prolapsus ani, especially in children, are prone to occur in severe cases.

The *discharges* may be copious, dark brown, thin, and highly

offensive (bilious dysentery), may contain occasional hard, round fecal casts of intestinal sacculi (scybala), or may become more and more scant until with the most violent efforts only the minutest quantity is extruded of mucus, generally streaked or tinged with blood (rose mucus), like the rusty sputum of pneumonia. Later all effort at emptying the alimentary canal may be futile (dysenteria sicca), or the mucus may be pure or commingled with pus to remain perfectly colorless (dysenteria alba), or with blood in larger quantity (dysenteria rubra). In other cases, or at other periods in the same case, the discharges consist of fleshy masses composed of inspissated mucus or pus, blood, and tissue débris (lotura carnea). Sometimes, though rarely, the discharges consist of pure blood, but oftener of a copious turbid fluid which, on standing, separates into a clear upper layer of serum and a sediment of disintegrated lotura carnea. Or, lastly, the sediment is composed of small, round vitreous masses, evidently swollen by maceration to look like sago grains, which have been erroneously supposed to represent the liberated contents of the intestinal follicles.

Neither the pain nor the prostration is so characteristic of dysentery as the stools, which, though of very varied nature, are nevertheless distinctive. After the discharge of the intestinal contents the first evacuation consists of mucus in the form of glairy, stringy matter, like the white of an egg, expressed as the result of the violent efforts at straining. The mucus may be pure or tinged with blood, but it is usually very scant in quantity, and stands in this regard in marked contrast with the violence of the efforts to secure its extrusion. It is the *frequency* of its discharge which constitutes an especial distress. Twenty to forty, even two hundred, times in the twenty-four hours the patient must go to stool. In the worst cases the patient sits at stool or lies upon the bed-pan the most of the day.

The mucus is sooner or later mingled with pus or stained with blood. The presence of blood is equally characteristic of dysenteric stools. Usually it is intimately commingled with the mucus or pus, or forms the chief element of the copious so-called bilious discharge. The evacuation of pure blood indicates erosion of vessels low in the colon, often in the rectum itself, though enormous quantities of blood are sometimes voided from unbroken surfaces.

Besides the mucus, pus, and blood, the dysenteric stool contains the sloughs which have been torn off by violent peristalsis in cases of the diphtheritic form. Usually they are separated in shreds and fragments, but occasionally large sheets, even casts of a section of the colon, are voided *en masse*. These fragments consist for the most part of inspissated mucus, pus, blood, and tissue débris, but there is

no doubt that in some cases partially necrosed mucosa also enters into their construction. One enormous tubular cast fourteen inches long, preserved in our Army Medical Museum, was found to be "composed of pseudo-membranous lymph, in which no trace of the structure of the mucous membrane could be detected" (Woodward).

There still remains to be mentioned the boiled-sago or frog's-spawn matter, whose origin has given rise to such a curious mistake. Not infrequently these vitreous-looking bodies compose the bulk of the sediment in the stools of dysentery, and even some of our modern authors, unacquainted with the more searching investigations of Virchow, have regarded them as expressed contents of intestinal follicles. Virchow found that under the application of iodine they always assumed a blue color. They are simply granules of starch ingested as food, to remain partially or wholly undigested.

The general condition of the patient suffers correspondingly. There may be fever or there may be none throughout the whole course of the disease, but the pain and discharges quickly exhaust the strength of the patient, and in severe or long-continued cases lead to emaciation and profound prostration.

FIG. 168.— Descending colon with sloughing pseudo-membrane (Medical History of the War of the Rebellion).

The skin is hot and dry; the tongue is heavily coated; the face wears an anxious expression. The abdomen is tumid with gases, or in more advanced cases sunken, discolored, and tender, especially in the course of the colon, whose thickened walls may be often felt beneath the emaciated surface. The anus is spasmodically

constricted, or in the worst cases paralyzed, patulous, and livid or blue. Prolapse of the rectum is common in children, and excoriation of the perineum by the acrid discharge is not infrequent.

Finally a typhoid state may set in or a pyæmia occur, when the discharges may become involuntary or unconscious, and brain symptoms—insomnia, stupor, delirium, and coma—supervene; or the patient may linger long enough to perish by simple exhaustion or marasmus.

Under favorable hygiene the great majority of cases of catarrhal dysentery recover without special treatment in the course of from three to ten days, but specific dysentery has no definite *duration* and but little tendency to spontaneous cure. The worst cases are often quickly controlled by appropriate interference, and the most surprising results may be sometimes obtained in cases of even years' duration. On the other hand, a certain percentage of cases is characterized by a defiance to every kind of treatment, including the last resort, a change of climate.

An acute case of catarrhal dysentery generally subsides without lesions, and the natural duration of the attack may be much abbreviated by proper treatment. Epidemic dysentery lasts from two to four weeks, or, becoming chronic, continues for years or for life, with exacerbations and remissions.

Various complications are liable to occur in the course of the disease. Three deserve especial mention—viz., affection of the joints (rheumatism), paralysis, and abscess of the liver. Perforation and peritonitis are always possibilities, and deformities of the colon, thickenings, and constrictions are not infrequently left.

Morbid Anatomy.—Catarrhal dysentery shows hyperæmia of the mucous surface, limited, in a large majority of cases, to the large intestine. The hyperæmia is most marked in the lowest parts of the intestine, the rectum, or descending colon. The whole process may be arrested at this stage, or it may increase to lead to softening of the cells and desquamation, the fundamental, anatomical characteristic of dysentery, by which process the submucous connective tissue is laid bare and ulceration results. In other cases a pseudo-membranous or diphtheritic process is developed. This condition may vary in intensity from a mere frosting of the surface to dense infiltration of the entire thickness. Subsequent sloughing may ensue. The fall of the slough leaves the dysenteric ulcer. Its edges are irregular and ragged, its base uneven like a crater, and its surface is more or less covered with pultaceous débris. Perforation from such an ulcer is fortunately rare, but is the most frequent cause of peritonitis in chronic dysentery. In rarer cases perityphlitis may ensue, or periproctitis with perineal abscess, or, finally, fistulæ may form

to burrow about and discharge themselves anywhere in or upon the surface of the abdomen, the lumbar region, or the thigh. The author once saw in consultation a case of fistula which extended from the descending colon to the vagina. Through the opening made to discharge the pus from a fluctuating abscess pointing into the vaginal vault, an india-rubber tube was passed for six or eight inches. The patient died finally from marasmus. Ulceration shows itself in chronic dysentery in every grade and stage, from superficial denudations to old cicatrizations. In bad cases the whole course of the colon from the ileo-cæcal valve to the rectum may constitute one vast tract of suppuration. Chronic dysentery is marked by atrophy of glandular structure and hypertrophy of the wall of the bowel.

FIG. 169.—Descending colon with oval ulcers (Army Medical Museum).

Complications and Sequelæ. — Pyæmia announces itself with a series of chills, followed by irregular temperature, by the speedy occurrence of multiple abscesses in distant organs, venous thromboses, affections of the serous membranes, pleuritis, pericarditis, and embolic pneumonia. Gangrene of the intestine, which may occur as early as the third day of the disease, is evidenced by the signs of general collapse.

Arthritis, when it occurs, shows itself, as a rule, in the second week of the disease, or after the disease has run its course, during the period of convalescence. All authors who admit it describe the knee joint as being the most frequent seat of the affection, but acknowledge that it is mostly polyarticular; while there is much difference of opinion whether it ever presents the general signs of true rheumatism—pyrexia, diaphoresis, or its complications on the part of the heart. It usually lasts four to six weeks, but neither its occurrence nor its severity stands in any relation to the intensity of the attack of dysentery. It is probably to be regarded as a manifestation of a light pyæmia or septicæmia, as it is a frequent manifestation of this condition in or after scarlatina, puerperal fever, and the septic fevers of surgery, where it is a streptococcus infection.

Paralysis has been observed to occur after dysentery ever since

the days of Galen. It is usually confined to the lower extremities, but may extend to and involve the upper extremities, by preference in the form of paralysis transversa (opposite arm and leg).

Abscess of the liver gives rise to few distinctive symptoms, and is mostly recognized or suspected, in the absence of positive signs, by the persistence or obstinacy of dysentery. The ease and impunity with which aspiration may be performed in its recognition justify the use of it in every doubtful case.

Dysentery may be further complicated by parotitis; by venous thrombosis (phlegmasia dolens); by diphtheritic deposits on other mucous surfaces, which Virchow declares to be exceedingly rare; and by hydrops, which is oftener a concomitant of the period of convalescence.

Besides the deformities of the colon which may ensue as a consequence of ulceration or peritonitis, a long attack of dysentery is apt to leave a hyperæsthetic or non-resistant state of the mucous surfaces, so that every imprudence in exposure or in diet begets an intestinal catarrh or a relapse of the disease.

Diagnosis.—The tormina and tenesmus, the peculiar discharges, the rapid reduction of strength, leave no doubt as to the nature of the affection. The prevalence of an epidemic of the disease will often establish the character of a case even when all the signs are not present or when anomalies occur. Embarrassment in diagnosis only attends the recognition of catarrhal or isolated cases, and in these cases there may be a doubt as between dysentery and diarrhœa—if such a symptom can be called a disease—or typhoid fever, cholera, or some purely local affection of the rectum, cancer, hæmorrhoids, etc. In children difficulty of diagnosis may arise as between dysentery and intussusception.

Dysentery is differentiated from that lighter form of intestinal catarrh whose main symptom is diarrhœa by the presence of tenesmus in dysentery, as well as by its mucous, muco-purulent, diphtheritic, and bloody discharges. Dysentery lasts longer than diarrhœa, as a rule, and does not yield so readily to treatment.

Typhoid fever shows from the start brain symptoms, which are absent from dysentery; has a typical temperature curve, whereas there may be no fever in dysentery, or, if any, it is of irregular, remittent type; is often prefaced by epistaxis and attended with bronchitis, both of which are absent in dysentery; and exhibits ochre-colored, pea-soup stools altogether different from those of dysentery.

Cholera morbus distinguishes itself from dysentery by its sudden onset, its profuse vomiting and discharges, its violent cramps and speedy collapse.

Cancer of the rectum can be usually felt, and hæmorrhoids can be always seen, so that no difficulty should be experienced in the recognition of these cases.

Intussusception occurs mostly in children, and has, in common with dysentery, vomiting, mucous or bloody stools, colic, tenesmus, nervous unrest, and prostration, so that a differential diagnosis may be impossible for a few days. The more strict localization of an intussusception, which may sometimes be felt as a sausage-like mass, most frequently in the right ileum and hypochondrium, the greater frequency and persistency of the vomiting and pain, the presence, visibly or palpably, of the invaginated gut at the anus or rectum, soon enable the careful examiner to recognize the case.

Prognosis.—The prognosis of dysentery varies between extremes. Catarrhal cases are mostly so mild as to terminate of themselves, under favorable hygiene, without special treatment. On the other hand, no known disease has a more frightful mortality than dysentery in some of its epidemics, especially in army life. It was this class of cases which Trousseau had in mind when he called dysentery the most murderous of all diseases. Sixty to eighty may be the appalling percentage of death in these cases.

Complications on the part of the nervous system, the status typhosus, pyæmia, and great prostration necessarily render the prognosis grave, yet even these cases are not necessarily fatal. Cases have recovered after complete paralysis of the sphincter ani. The recognition and discharge of an hepatic abscess relieve the patient from the dangers of this complication. Peritonitis alarmingly aggravates the prognosis, and perforation is almost of necessity fatal.

Prophylaxis.—The improved sanitation of modern times has already diminished the frequency and mitigated the severity of epidemics of dysentery; and this fact, which is only an accidental observation, as it were, gives the clue to the means of its further prevention.

The selection of proper sites for camping grounds, barracks, and hospitals, the prevention of overcrowding in tenement houses, ships, and jails, the regulation of sewage, care for the food and drink, the observation of the strictest cleanliness by authoritative control—all these are general measures which suggest themselves in the prophylaxis of this or any disease.

In the management of individual cases the first precaution is to prevent the dissemination of the disease, as this protection of others secures also for the individual patient the most favorable hygiene.

The bedding must be frequently changed; the windows kept open to secure free ventilation, which, in the light of existing knowledge, is the only true disinfectant; and all the furniture of the sick-room,

especially including the receptacles for the discharges, must be kept perfectly clean. For this purpose the best purifier is boiling water.

The drinking-water should be secured, during an epidemic, from the purest possible source; and if good drinking-water cannot be had, what there is should be thoroughly boiled.

The discharges should be properly mixed with sawdust or some combustible substance and burned; or, if this be impracticable, should be buried in the soil a few feet below the surface, and not emptied into water closets or privy vaults used by others.

Such articles of food should be abjured as have a tendency to produce intestinal catarrh. So unripe fruits, vegetables which readily undergo fermentation—in short, all indigestible substances—should stand under ban. But no prohibition should be put upon ripe fruits or simple, nutritious food of any kind. Lastly, liable individuals should protect themselves from catching cold.

Treatment.—The first requisite in the treatment of an individual case is perfect rest. Patients with even the lighter forms of catarrhal dysentery should observe the recumbent posture, and cases of more serious illness should be put to bed. Rest in bed, an exclusive diet of milk—which should always have been boiled—and the time of a few days is sufficient treatment for the mildest case. Where there is objection to milk, meat soups, with or without farinaceous matters, rice, barley, etc., may take its place.

A case which is somewhat more severe will require perhaps a light saline laxative—a Seidlitz powder, a dose of Rochelle or Epsom salts in broken doses—or a tablespoonful of castor oil or five to ten grains of calomel, to effect a cure. For the relief of the pain of the lighter cases nothing is equal to tincture of opium, of which five to ten drops every three or four hours, in a tablespoonful of camphor water acidulated with a few drops of hydrochloric acid, will generally suffice; Dover's powder in broken doses, one to three grains, with five to fifteen grains of bismuth or soda, or both, is a good substitute for a change. Salol in tablet gr. v., or hydronaphthol in keratin-coated pill gr. v., every hour or two, sometimes cures the disease.

The successful treatment of dysentery in any form depends upon a recognition of the fact that the disease is local as to its seat and is probably specific as to its cause. Anodynes relieve effects, but laxatives must remove the cause. Consequently the most rational treatment of the severer cases is the irrigation of the large intestine and the thorough flushing out of its contents. Since Hegar has recently shown how the whole tract of the large intestine can be thoroughly inundated and flushed with a common funnel and rubber tube, the practice has continually gained ground, until it is now admitted as the most valuable method of treatment. Wood of Philadelphia,

and later Mackenzie of London, reported a number of cases in which irrigation of the bowel with large injections medicated with nitrate of silver, ʒ i.–Oi., was attended with the most surprising results, sometimes but a single injection effecting a cure ; and the author has reported a case, almost in articulo mortis, where complete cure followed the irrigation of the bowel—on three occasions with three pints of water containing three drachms of common alum. This case was all the more instructive from the fact that a relapse had occurred after very striking but only temporary relief had been obtained with the nitrate of silver, the alum having been substituted simply on the ground of expense. Usually half a drachm to the pint will suffice for either drug. Tannin in one-per-cent solution is a good substitute.

The object is to introduce as much cold water as possible without producing too much pain. The large intestine of an adult holds, on an average, six imperial pints, but in the author's experience not more than three or four pints can be, as a rule, safely introduced. The patient should lie upon the back or left side, with the hips elevated and the head low, while the injection is slowly introduced from a funnel, fountain, or a bulb syringe whose nozzle is thoroughly anointed with vaselin. In the absence of a thoroughly competent assistant the operation should be performed by the physician himself, for the proper use of an irrigating enema is a practice which requires both judgment and skill. When pain is experienced the further influx of the fluid should cease for a few minutes, when it may be resumed again and again until the largest possible quantity is introduced. It is impossible to overestimate the value of this treatment in cleansing, disinfecting, and constringing the foul and flabby surface of the whole seat of the disease. As was said by Hare: "It changes a huge internal into an external abscess, and enables us to cleanse the bowel of its putrid contents."

Of all the remedies which have been recommended in the relief of dysentery, besides the irrigation method, but one—ipecacuanha—deserves the name of a specific.

The remedy is best administered in large doses, gr. xx.–xl., and should be repeated every four to twelve hours until permanent good effects are secured. A dose of fifteen to thirty drops of tincture of opium, or morphia one-fourth grain hypodermatically, will best protect the patient from too great exhaustion. The beneficial results are mostly obtained in the acute cases, though surprising results sometimes follow in cases of very long standing. Should the remedy fail to be of service in the course of twenty-four hours, it should be discontinued.

Suppositories of opium and belladonna with cocoa butter quickly relieve severe tenesmus. Clysters of nitrate of silver gr. iv. and

water ℥ v. (Duchs), or with a few drops of tincture of opium (Berger); of ipecacuanha (Begbie and Duckworth); of laudanum and starch (Sydenham, Abercrombie); of the various astringents, especially acetate of lead gr. viij. and water ℥ iv., may be tried in obstinate, more especially chronic, cases.

Local inspection of the rectum by means of the speculum may possibly reveal an ulcer, which is the chief or sole cause of the tenesmus and bloody discharge. Maury reports such a case, in which the

Fig. 170.—Cicatrices of diphtheritic ulcers in the colon (Medical History of the War of the Rebellion).

ulcer was deep enough to hide a small sponge. In such cases topical treatment may effect a cure.

Dilatation may suffice to overcome a stricture in the rectum, the result of cicatricial contraction, or colotomy may be necessary in cases more refractory or situated higher in the bowel. Post reported a successful colotomy, with the formation of an artificial anus in the left lumbar region, in such a case. Perforation calls for immediate laparotomy.

In all cases of pronounced prostration stimulants are to be freely

used; and of all stimulants alcohol is the best, as it has also nutritive and antiseptic properties. Alcohol is thus trebly indicated in the treatment of dysentery, but the choice of the form and strength will be a matter of judgment in the individual case.

Where life is imperilled by hæmorrhage or anæmia from any cause, a forlorn hope is offered in subcutaneous transfusion of salt water (boiled), one drachm to the pint.

Abscess of the liver is best treated by aspiration or hepatotomy, rheumatism by the salicylates, and paralysis by the constant current of electricity.

Obstinate cases of chronic or continually recurring dysentery are thoroughly cured only by a sea voyage, a sojourn at the sea shore, a mountain excursion, or a permanent change of climate.

CHOLERA.

Cholera (χολή, bile, ῥέω, to flow, from ancient erroneous conception, as it is precisely the bile which does not flow); Indian or Asiatic cholera, as distinct from cholera nostras, cholera morbus.—An exquisitely acute infection of the intestines, caused by a spirillum ingested with the drink, characterized by profuse discharges like rice water from the bowels and stomach, congelation of the blood, suppression of urine, huskiness of voice, cyanosis, cramps and collapse; or reaction and recovery; or at times, later, a typhoid state.

History, Geography, etc.—Asiatic cholera was unknown to the old Greek writers. They applied the term to our cholera morbus or cholera infantum. Yet the disease has had its home and haunt from time immemorial on the banks and swamps of the Ganges and Bramaputra, where it finds the necessary heat, moisture, and decomposition to perpetuate its cause. But it never broke its leash until 1817, when it appeared in Jessora, and later Bagdad, 1819, and travelled thence across Persia to the Trans-Caucasus (Tiflis), whence it was carried to Astrakhan, September, 1823, and was here effectually killed by the extreme cold of October of that year. The next outbreak made itself memorable as the first real pandemic of the disease. It started from the Ganges in 1826, reached China in 1828, whence it was shipped to Orenburg and Astrakhan, 1830. Thence it reached Russia in 1831, and in the same year invaded Prussia, appearing for the first time in Berlin and Hamburg. From Hamburg it was carried to England, and thence by Irish emigrants to Canada (Quebec) and the whole of North America in 1832. This attack did not cease until 1837. The third pandemic started in India in 1848, reached China, Persia, European Turkey and Russia, Siberia, Germany (Hamburg), Hull, and thence in the same year New York and New Orleans and the whole of the United States. This epi-

demic visited Norway, Sweden, and Denmark for the first time in 1853. The disease did not die out in Europe until 1861. The fourth pandemic, 1863–75, was carried from the Ganges to Bombay, by pilgrims also to Mecca, Suez, Egypt, by ship to Constantinople and Marseilles. It reached the United States in 1866. In 1884 cholera appeared in Toulon, an importation from Egypt, and traversed Hungary, Spain, and Italy, reaching South America from Genoa. The epidemic of 1890–92 followed both northern and southern courses, reaching the west of Europe in 1892. This outbreak, highly fatal at Hamburg, was successfully quarantined at New York Harbor in 1893. The Cholera Bacillus was discovered by Koch in India in 1884.

Etiology.—Cholera is a purely "water-borne disease" (E. Hart). Certain places are always visited, others often spared by visitations of cholera. Porous soils, sinking subsoil water by opening access to oxygen, more especially by contaminating wells and drinking-water, favor the development of cholera. Cities of valleys and plains are oftener or more severely attacked than those of elevations or mountainous regions. Assemblages of multitudes in pilgrimages, camps, etc., especially under bad hygiene, favor the spread of the disease. Cold weather inhibits and checks the growth of the spirillum and puts a stop to an epidemic. Of individual considerations age is important. The young are likely to escape altogether or suffer a mild attack, largely on account of active (acid) gastric juice and rapid peristalsis, which destroy and expel the cause of the disease. The old and enfeebled suffer most. Imprudence in diet and drink (alcohol), bad habits of any kind, catarrh of the stomach or intestines, dyspepsia and diarrhœa, predispose to the disease. That amount of fear which leads to prudence in diet, care of the drinking-water, including milk and all other drinks, protects against the disease. Excessive or abject fear increases the liability.

Bacteriology.—The cholera spirillum is a curved rod like a comma, the "comma bacillus," flagellated, endowed with motion, 1–2 μ long (vide Frontispiece, Fig. 14). It is an aërobe, though it may still develop in the absence of oxygen, with optimum temperature at 85°–106° F. It ceases to grow at 60° F., but perishes only after thorough freezing. It is very sensitive to acids, is speedily killed by sublimate, carbolic acid, etc., and quickly dies under desiccation. It grows in all kinds of culture soils, luxuriates in fresh milk, but perishes at once so soon as the milk becomes sour. It lives on bread (rye) one day, on bread wrapped in paper three days, on bread under a glass cover seven days, on the surface of feebly acid butter four to six days, in beer twenty-four hours, in acid (0.7 per cent) wine but fifteen minutes. It perishes at once in lemonade (Uffelmann), which is therefore a better drink than even dilute muriatic acid during the

prevalence of cholera. The spirillum freshly discharged is feeble. It gains in tenacity out of the body, so that it resists the action of the gastric juice. It lives longer in contaminated than in pure water It has been demonstrated in well water after thirty days (Koch), and in harbor (sea) water eighty-one days (Nicati and Rietsch). Koch found it in India in streams contaminated by the washing of cholera linen and in tanks used for drinking water. Fresh aërobe cultures of the cholera spirilla develop a special poison of extraordinary intensity. Thymol, chloroform, desiccation, which destroy the spirilla, do not attenuate the virulence of this poison. Most of the symptoms of cholera are attributed to the action of this cholera toxine.

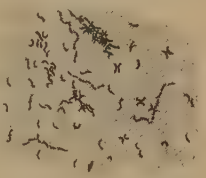


FIG. 171.—Comma bacillus of cholera, pure culture.

The cholera spirillum is usually easily demonstrated in the discharges by fuchsin or methylene blue. A rice-water flocculus is often almost a pure culture. Cases of doubt may be determined by cultures. A quantity of the discharge is added to a double quantity of alkaline bouillon and kept at a temperature of 100° F. Colonies which quickly show on the surface may be transferred to plate cultures. On gelatin plates the colony grows as flat, yellow discs, which in one day fluidify the soil and show under the lens a granulated appearance, as if the surface had been strewn with small pieces of glass (Koch) (vide Frontispiece, Fig. 11). Stick cultures show a line of fluidified gelatin, expanding at the top to a small funnel, a point of distinction from simulating bacteria (vide Frontispiece, Fig. 8). The addition to bouillon cultures of five to ten per cent common nitric acid develops a violet color. The addition of sulphuric acid, with subsequent neutralization with soda, develops a Burgundy red, the so-called "cholera red."

Symptoms.—Cholera begins suddenly, often in the night, with *diarrhœa*, which voids first the contents of the bowels stained with bile; later, in the course of an hour or two, the characteristic alkaline *rice-water discharges*. The discharges are voided without effort, pain, or tenesmus. They gush from the body in such quantity, fifteen to twenty during the day, as to drain the blood. *Vomiting* now sets in—at first of the contents of the stomach, with bile regurgitated from the duodenum; later, through an incontinent pylorus, of the same rice-water contents of the small intestine. The vomiting is also without effort or strain. It gushes from the mouth and is sometimes projected several feet from the body. The patient soon falls into collapse, with precordial constriction, *intense anxiety, unappeasable thirst, heart failure*, and faintness. During the attack *cramps* develop in the *calves of the legs*, later in the arms and

abdomen, not suddenly or universally at a stroke, as in tetanus, but more gradually, successively, one after another, to the indescribable torture of the patient while they last.

The disease is now at its height. The *surface is cold*, tinged with blue on a gray ground. A wide black halo lies about the deep-sunken eyes. The nose is pinched, the lips livid, the tears dried up, the cornea grows opaque. The breathing is oppressed and difficult; the very breath is cold. The *voice is husky*, reduced to a whisper, and lost. The urine is reduced more and more. Finally the kidneys fail entirely. There is often complete *anuria*, generally for a period not longer than a day or two, in fatal cases often for the greater part of a week. The discharges continue profuse. The anxiety gives way to *apathy*. The mind, clear from the start, becomes clouded. The heart's action grows feebler and feebler, cyanosis increases, and the patient dies of asphyxia.

This scene represents the first stage, or the *stage of asphyxia*. It lasts from three to thirty six hours, and is followed, in cases which recover, by the second stage, the *stage of reaction*. The discharges now cease in frequency, cease altogether, or become natural and are again tinged with bile. The pulse grows stronger, the surface warmer or bathed in sweat, the secretion of urine is re-established, is sometimes increased beyond the normal amount (polyuria), the appetite returns, the patient gains strength; convalescence is established.

Unfortunately, in a certain percentage of cases the reaction does not stop at the standard. It goes beyond; it becomes excessive. Fever increases, the mind becomes clouded, the tongue is coated, the lips are covered with sordes, the voice is again reduced to a whisper, the kidneys fail, and the patient, under the signs of uræmia or toxæmia from chemical products of the bacillus, sinks into the dangerous state known as the *cholera typhoid*.

Eruptions of various kinds may now occur: erythema, roseola, urticaria, first on the forearms and wrists, later on the face and body, rarely widely scattered anywhere; or various more dangerous complications or sequelæ may develop. Thus croupous or catarrhal pneumonia, meningitis, decubitus, gangrene, erysipelatous inflammation, diphtheritic, ulcerative, and destructive processes somewhere in the course of the alimentary canal, may occur to threaten or take life which has survived the disease itself.

Forms.—During the prevalence of an epidemic a great many cases develop nothing more than a more or less sharp diarrhœa with dyspeptic signs lasting over the greater part of a week. These are the cases of so-called cholerine—little, *mild*, or light cholera—most dangerous cases in the dissemination of the disease. These patients

go about soiling linen, and through defective sewerage contaminating drinking-water with their dejections, until cases multiply to constitute an epidemic. In other cases the attack is *foudroyant*. Such attacks may take life in the short space of two hours. Between these extremes are attacks of every grade of intensity. More rare are the cases in which no discharge at all appears—cases of so-called *cholera sicca*, dry cholera. Many of these cases succumb rapidly. The paralyzed bowel is found filled to distention, unable to expel its contents.

Morbid Anatomy.—Post-mortem rigidity sets in soon; decomposition is delayed. The body is cold and blue. Emaciation may be pronounced. The skin is shrunken. The muscles may show post-mortem tremor (fibrillation), whereby members of the body or the whole body may be moved. The intestine, more especially the ileum, is distended with the rice-water fluid, which is grayish white, odorless, and full of flocculi. The mucous membrane is hyperæmic and swollen, or œdematous, macerated, and denuded of epithelium. Ecchymoses are abundant; diphtheritic deposits, ulcerations are not infrequent. The internal organs are drained of blood and dry. The blood in the right heart is often thick like tar. The spleen is small, its surface wrinkled. In protracted cases the kidneys show evidence of profound lesion in degeneration of the epithelium of the urinary tubules, as a result, not of stasis, but of poisoning by the cholera toxine (Aufrecht).

The *diagnosis* is easy in the presence of an epidemic, though cases of poisoning by the metals, especially by arsenic, and cases of heat stroke, have been included in cholera times. First cases are difficult, though these cases are not so dubious under the present rapid dissemination of news. The true physician, who hesitates to alarm a community unnecessarily, will not be deterred by fear of adverse criticism from declaring a diagnosis. The safety of a community depends upon the recognition of the first cases. The peculiar rice-water discharges, cramps, heart failure, cyanosis, and rapid collapse distinguish the clinical history. Cholera nostras occurs more especially in late summer and fall, in the absence of an epidemic or news of the advent or approach of true cholera. It begins with vomiting, as a rule; purging follows later. The discharges of cholera morbus are not like rice water, as a rule, though such discharges may occur.

The diagnosis really rests upon the recognition of the cholera spirillum in the discharges or upon linen. The best demonstrations are made with the carbol-fuchsin solution. Caution must be used with alcohol in withdrawing the water, as the comma bacillus very readily gives up its color (Neelsen). It is not colored by the method of Gram. For practical purpose the inoculation of gelatin in a clean

saucer will suffice; for the appearance of the dotted or stippled surface, the "broken glass" surface, from irregular fluidification of the gelatin in the short space of twenty-four hours, is *absolutely peculiar to the comma bacillus of cholera* (Pfeiffer). The tube tests, which take a longer time, are thus rendered superfluous. But *superflua non nocent.* The cholera spirillum is differentiated from simulating structures, those of Finkler-Prior, Deneke, Escherich, etc., by different action on culture soils.

To confirm the diagnosis of cholera a flocculus is picked from the fæces or from the linen with a platinum needle previously sterilized at a white heat. This flocculus is introduced into a test tube partly filled with warm, 86° F., agar-agar, previously sterilized by boiling. The particle is distributed throughout the gelatin. Three or four drops are now taken from this tube and inserted into a second tube, and from this second tube in like manner into a third tube. The contents of these three tubes are now poured out upon the surface of three glass plates which have been previously sterilized by washing in a sublimate solution and thorough heating for a long time. Here the gelatin is allowed to set. The three plates are now banked one above the other, and covered in by a bell glass cover—three soup plates will suffice—whose interior is kept moist and pure by being lined with a layer of filtering paper moistened in a sublimate solution. Colonies which form on the third day are now examined under the microscope, and suspicious bodies are proved with the stick cultures in tubes filled with solid gelatin (agar). Studies of motion are also made in hanging drops. Information furnished by all these methods establishes the diagnosis.

Poisoning by the metals, corrosive sublimate, more especially arsenic, is eliminated by the detection of these substances by chemical tests. Heat strokes show no comma bacilli in the stools.

The absolute diagnosis of cholera is determined at Koch's Institute, Berlin, in six ways: 1, by microscopic examination; 2, by peptone culture; 3, by gelatin culture; 4, by agar culture; 5, by the cholera-red (indol) reaction; 6, by inoculation of guinea-pigs.

1. The microscopic examination alone declares the diagnosis in half of all cases. A rice-water floccule on the cover glass stained with diluted Ziehl's fuchsin solution is seen, in the case of true cholera, to show numbers of comma bacilli, all disposed in the same direction, that is, apparently following each other like a school of fish in a sluggish stream. This appearance is itself characteristic.

2. The peptone culture is prepared by adding to a sterilized watery solution of peptone and common salt, each one per cent, as much soda as will make the solution strongly alkaline. Examination for bacilli is made in twelve hours after inoculation of the soil.

3. The gelatin plate culture—*i.e.*, twenty per cent gelatin in oven at 22° C.—shows the characteristic appearance in fifteen to twenty-two hours.

4. The agar plate culture displays colonies in eight to ten hours.

5. The cholera-red (indol) reaction is obtained by adding a nitrate to the peptone culture soil containing pure cultures of cholera bacilli. Sulphuric acid (pure) develops the peculiar color.

6. The inoculation test consists in the introduction of a platinöse of 1.5 milligrammes agar culture with 1 cubic centimetre sterilized bouillon into the peritoneal cavity of a guinea-pig of three hundred to three hundred and fifty grammes weight. The animal perishes in a short time with typical symptoms of poisoning and fall of temperature. No other curved or spiral bacteria have yet been found which will in a dose so small produce anything like the same symptoms.

Finally, the drinking-water should be tested with the peptone culture soil, and the numerous bacteria thence derived examined and tested as before. Cholera bacilli were thus disclosed in the river Elbe and in wells, etc., in the epidemic of 1892 in Hamburg and Altona.

The *prognosis* is always grave. The mortality, excluding cholerine and the lighter forms of diarrhœa, ranges about fifty per cent. It is always highest in the beginning of an epidemic, and greatest among the aged and enfeebled.

Prophylaxis consists in quarantine at sea. There is no excuse for cholera in lands separated by oceans. A sea blockade as effective as that of the South in the late war would suffice to bar out cholera, and the expense entailed would be a trifle compared with the cost of an epidemic. Land quarantine is useless because necessarily ineffective. Detention of passengers from infected ports in quarantine, especially of all individuals affected with diarrhœa, and disinfection of all soiled linen under dry heat, 250° F., constitute the best prophylaxis. The thorough cleansing of cities, with house-to-house inspection by intelligent sanitary officers armed with authority and, if necessary, provided with means of indemnification for destruction of dangerous property (clothing, bedding, etc.), with care for pure drinking-water and discharge of sewage, has much to do with the prevention of the disease. During the actual prevalence of an epidemic people best protect themselves by prudent habits, personal cleanliness, and the use of pure drinking-water. They who can afford it may partake only of the mineral or carbonated waters or light wines; all other waters should be thoroughly boiled. The milk should be boiled. The digestion should be kept sound by care as to diet, if necessary by the use of dilute hydro-

chloric acid gtt. x–xx. in a wineglass of cold water before meals. *The slightest diarrhœa demands prompt attention.* The discharges of patients should be buried, or mixed with sawdust and burned. Soiled linen as it accumulates must be kept in a five-per-cent solution of carbolic acid and later subjected to dry heat. Utensils, bed-pans, etc., should be washed out with carbolic acid solution.

Immunity.—Brieger, Wassermann, and Kitasato injected into guinea-pigs cholera cultures in a soil of thymus-gland tissue heated to 65° C. fifteen minutes and cooled in an ice chest twenty-four hours. The animals were thus rendered absolutely immune to virulent cholera cultures, surviving the introduction of three times the quantity fatal to control animals.

Klemperer induced immunity with cultures attenuated by heat, also by the galvanic current. Blood serum from animals immunized in this way produced immunity in other animals. Haffkine secured from pure cultures of cholera bacilli a so-called anti-cholera vaccine, with which he inoculated himself and other men, securing protection against the virulent disease. All these methods are now under trial.

Treatment.—The most important element in treatment is the arrest at once of diarrhœa by an opiate, which is made more efficacious by the addition of an acid.

℞ Tincturæ opii..... ℥ i.
Acidi hydrochlorici diluti..... gtt. xl.
Aquæ camphoræ..... ℥ iv.
M. S. A tablespoonful every hour or two.

Rest in bed must be absolute. A mild case may be controlled by a suppository of opium, one grain, especially at night. A more severe case calls for morphia subcutaneously, in dose of one-fourth grain to an adult. To children the tincture of opium must be given with caution. One drop is the dose for the first year. A child over two years of age may take a teaspoonful of the mixture just prescribed. The algid state must be counteracted by heat. The patient may be wrapped in blankets, with bags, jugs, and bottles of hot water along the spine, sides of the body, and at the feet. Hot sand bags retain heat a long time. The intolerable thirst may be appeased with cracked ice, and the patient may drink freely of pure carbonated waters. Vomiting is best controlled by chloral. Mustard plasters to some extent allay epigastric pain. Friction helps the cramps somewhat. Quicker relief is offered in very bad cases by injections of chloral, gr. v., deep into the substance of the muscle. Persistent diarrhœa, vomiting, and cramp may be stilled by a repeated hypodermatic injection of morphia. Irrigation of the whole bowel with a hot one-per-cent solution of tannic acid (entero-clyster)

or with very weak sublimate solutions 1 : 100,000 is all the more indicated because the rice-water discharges contain so little albumen to weaken the parasiticidal effect. In the absence of any specific address to the toxine in the blood, attempt is made to counteract the drain by transfusion with salt water, which is best practised subcutaneously. Samuel recommends a solution of the strength of one-half drachm to the pint of sterilized, warm, 105° F., water injected continuously at the infraclavicular fossa. Cantani prefers a solution of common salt ʒ i., carbonate of soda gr. xlv., distilled water one quart, introduced at the sides of the body (loins), behind the ribs, by means of a fountain syringe. The skin is punctured with a fine canula, the trocar withdrawn, the tube adjusted, and the fluid allowed to flow, absorption being hastened by massage. Cantani calls the process, which may be repeated on the other side, a hypodermatic clyster. There is no doubt of the great value of these injections, whereby patients recover at times even from states of asphyxia and unconsciousness. The salt solutions not only fluidify the blood, but also neutralize, to some extent, the poisonous action of the cholera toxines upon the nervous system. Unfortunately, the restoration does not hold.

Collapse is met with alcohol (brandy) by the mouth, also by subcutaneous injection. Keppler recommends for this purpose :

℞ Sodii bicarbonatis..... 7.0
Alcohol absoluti..... 10.0
Aquæ destillatæ.....1000.0

injected anywhere under the skin, warm, 37° C. (100° F.), fifty cubic centimetres, at first every minute, later, so soon as the pulse is perceptible, every five minutes, then every half hour. Camphor is also a good excitant :

℞ Camphor rasurarum..... ʒ ss.
Ether, sulphuric..... ʒ iiss.
M.

Inject ten drops at a dose. During the stage of reaction the attempt is made to secure free action of the kidneys, especially by copious draughts of warm water, hot baths, diuretics, etc. The treatment of the cholera-typhoid stage is wholly symptomatic and does not differ from that of typhoid fever itself. During convalescence the diet should be fluid—milk, soups, diluted egg, thin custards, gruels, etc.—for a week or more.

CHOLERA MORBUS.

Cholera morbus, nostras; European, sporadic cholera (χολή, bile, ῥέω, to flow, because the discharges are stained with bile); in infants,

cholera infantum.—An acute infection of the stomach and intestine, sporadic, occasionally endemic, characterized by vomiting and diarrhœa, cramps, heart failure, and rapid collapse.

Cholera morbus has been known from the most remote antiquity. It was this affection which received the name cholera. The cause of the disease has been ascribed to excessive heat, to exposure to cold, to bad diet, to unripe fruit, fermenting and decomposing food and drink, artificial feeding of infants, to contaminated drinking-water, etc. The disease is evidently due to the absorption of some toxine from the intestinal canal, though no particular micro-organism has yet been distinctly isolated from the myriad bacteria of the intestinal canal as its cause.

Symptoms.—The disease begins with *pains in the stomach and bowels,* severe colic with flatulence and rumbling, and is announced in the course of an hour or two with *vomiting* at first of the contents of the stomach stained with bile (bilious vomiting), and later *discharges from the bowels,* copious, offensive, also stained with bile, which are hurried along under rapid peristalsis. It usually ceases with these signs in the course of the same day, but may persist in the enfeebled or aged, more especially in childhood, to show the alarming signs of true cholera, rice-water discharges, cramps, hoarseness of voice, heart failure, anuria, cyanosis, and asphyxia or collapse. Convulsions and comatose states are common in children.

Diagnosis.—In severe form the disease may be differentiated from true cholera only by the detection of the cholera spirillum as established by its conduct on culture soils.

The *prognosis* is favorable. Most patients recover quickly under appropriate treatment. On account of damage to the heart an attack is dangerous in advanced life, and aged people occasionally succumb to the disease. The outlook is very grave in childhood under artificial feeding, where the form of the disease is more subacute, but becomes immediately favorable under recourse to a good wet-nurse.

The *treatment* consists in the prompt use of opium, as indicated under Asiatic cholera. Where the suffering is not too extreme for delay with this drug, recovery is hastened by first washing out the stomach with copious draughts of hot water, or preferably with the stomach tube. Irrigation of the bowel with solutions of alum water, four or five pints, half a drachm to the pint, assist in the same way. Where pain is severe an adult should receive at once a subcutaneous injection of morphia gr. $\frac{1}{6}$–$\frac{1}{4}$. Caution must be used with repetition of this use of morphia, as absorption is powerful under the drain of the discharges, and patients are easily narcotized. Cracked ice, and chloral gr. ij.–v. in peppermint water, will usually allay vomiting. The body must be kept warm with external heat, the heart's action

supported with alcohol, brandy, and analeptics, as already described. More protracted, obstinate (subacute) cases are best brought under control by astringent irrigations. The whole bowel is washed out with solutions of alum, tannin one per cent, or other astringent, as described in the treatment of dysentery. The stomach should be drenched with hot water.

PART II.

DISEASES OF ORGANS.

DISEASES OF THE ORGANS OF DIGESTION.

CHAPTER I.

DISEASES OF THE MOUTH, FAUCES, AND PHARYNX.

Diseases of the mouth for the most part reveal themselves readily to inspection. Daylight is the best. Evidence is sometimes shown in the condition of the lips, which may be swollen and fissured, as in cases of eczema, scrofula (tuberculosis). *Herpes* about the lips may signify merely ephemeral catarrhal infections, or may indicate pneumonia, cerebro-spinal meningitis, etc., so that herpes has both diagnostic and prognostic significance.

Cyanosis reveals itself usually first about the lips. A light-bluish tint catches the eye of the physician as an index of heart disease or impeded respiration (pneumonia). The same discolorations are evident on the inside of the mouth, especially about the region of the palate, where at times the light-yellowish tinge of icterus is first or is corroboratively observed. Certain drugs (antipyretics) give rise to a bluish coloration of the lips.

Tumefactions which may be visible upon the outside of the face are best examined by palpation with one finger inside, the other outside the mouth, whereby often inflammations of the gums, whether mere indurations or containing serum, blood, or pus, often in connection with carious teeth, are observed. The mucous membrane may be hyperæmic, indented by the teeth, ulcerated, or covered more or less extensively with membrane or sloughs as indicative of various forms of stomatitis.

The *tongue* may be swollen and indented by the teeth, or cut, ulcerated, showing bleeding wounds along its edge or scars indicative of epileptic attacks. The enlargement of the tongue is often a venous engorgement due to glossitis or to an extralingual infection. The most common cause of glossitis (stomatitis) is *mercurial poisoning*. In this condition the gums also become swollen, tender, as the first evidence of the condition. Effort is made in treatment of various conditions by mercury to avoid stomatitis, so that the administration of the drug should cease upon the first evidence of tenderness, as the patient closes the jaws more forcibly, or with the first ap-

pearance of increased saliva. The drug is most efficacious when the administration of it is continued up to the time when it (barely) touches the gums. It may still be administered (see treatment) with the simultaneous exhibition of chlorate of potash and frequent cleansing of the mouth. This continued administration is a great desideratum in many cases, notably in the treatment of dropsy of heart disease, where no remedy can take the place of calomel.

The recognition and treatment of affections of *the teeth* constitute the special department of dentistry, which has reached great perfection in our day. It falls within the province of the physician to emphasize the necessity of cleanliness and care of the teeth, which care should be extended also to the first set in a child, that the permanent set may be perfect. Notches in the incisors are recognized as an evidence of impaired nutrition. Late appearance, imperfect development, go along with rickets and syphilis. Semilunar excavation of the upper middle incisor, taken in connection with catarrh of the middle ear and keratitis, constitute the triad (not so infallible as Hutchinson claimed) in evidence of hereditary syphilis.

Occlusions, retention cysts, calculi, are sometimes, though rarely, discovered in connection with the salivary ducts. The hard and soft palate present distinctive evidence of disease. The physician has here to differentiate between simple, catarrhal, diphtheritic, and specific processes. The palate is a favorite site of *syphilis*. There is observed at first intense hyperæmia with swelling, which may not be separated from a simple catarrhal process. Later, however, distinct erosion of tissue occurs, whereby the soft palate is slit up often by the side of the uvula, or perforated to permit regurgitation of fluids through the nose—conditions often found associated with destructive lesion in the nose itself. The alæ nasi may be alone or simultaneously invaded, with gradual progressive erosion and subsequent marked deformity. The septum of the nose is perforated or the bridge broken down. The sunken bridge of the nose constitutes almost infallible evidence of lues. The lesions in the throat distinguish themselves by their painless but progressively destructive character. They distinguish themselves also by the rapidity of their disappearance and complete cure under appropriate treatment. In any case of doubt the patient should be subjected to this treatment, that the diagnosis may be established before irreparable deformity ensues.

The mucous membrane which lines the mouth and covers the tongue is dense, resistant, and relatively impermeable, so that, notwithstanding the exposure of these organs to insult and injury, disease of the mouth and tongue is rare. It is otherwise with the throat. The stomata of the tonsils, which permit the migration of leucocytes at all times (Stöhr), readily admit pathogenic micro-

organisms. The absorptive (lymphatic) system of vessels is peculiarly rich in the throat.

STOMATITIS.

Stomatitis (*στόμα*, the mouth) shows itself in a number of forms, catarrhal, ulcerative, gangrenous, and special affections have been set apart, as aphtha, thrush, and noma.

Micro-organisms have been found in all forms of sore mouth. In certain cases—thrush, actinomycosis—genetic relationship has been established. In other cases—forms of stomatitis, aphtha—micro-organisms find entrance only when normal resistance has been overcome or epithelial barrier broken by lack of nutrition, long maceration, chemical irritation (mercury), etc.

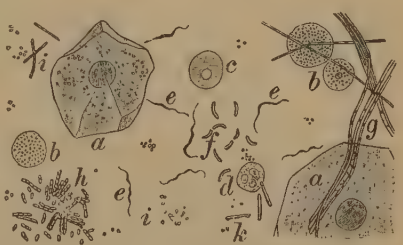


FIG. 172.—Mould fungi, etc., from mouth: *a*, flat epithelium; *b*, granules of saliva; *c*, fat; *d*, leucocytes; *e*, spirochætes buccalis; *f*, comma bacilli of mouth; *g*, leptothrix buccalis; *h*, *i*, *k*, various fungi.

STOMATITIS CATARRHALIS is produced by mechanical, chemical, or thermic irritant, as in infants by maceration from long suckling of empty breasts, or by an even worse habit, the use of sugar teats or bags, etc.; in adults more especially by strong tobacco and alcohol, hot, highly spiced or acid food or drink, caries of teeth, by certain infectious diseases, measles, scarlet fever, small-pox, typhoid fever, diphtheria; in connection especially with syphilis, sometimes with cancer, much more rarely with tuberculosis.

Symptoms.—Patients complain of *dryness, burning,* and positive *pain.* Infants at the breast whimper and cry with distress, and suffer actual inanition from *inability to take or retain the breast. The taste is lost* in adults, sometimes *the breath is foul,* more rarely salivation is profuse.

The mouth shows on inspection spots and surfaces of *redness and swelling.* The tongue, more or less heavily coated, is swollen, its edges often indented by the teeth. The gums may be swollen, spongy, tender, bleeding, or blue.

STOMATITIS ULCEROSA is distinguished by deeper lesions—viz., by necrosis and *destruction of tissue,* especially in the *vicinity of the incisor and canine teeth* of the lower jaw. The swollen, spongy gums bleed spontaneously or on the slightest touch, and epithelium breaks down later to leave an ulcer covered with a gray slough. The process may involve also other parts—the mouth, the lips, cheeks, border of the tongue, etc. The disease was more frequent in

old times under the abuse of mercury, but is now more frequent with disuse of the drug in connection with the lesions of syphilis. Bad cases may be associated with inflammation of neighboring lymph glands, may show œdema, gangrene, and sepsis, or, after extensive sloughing of the gums, result in periostitis, caries, and sequestration of bone.

The disease is most frequent in childhood, and sometimes assumes, under conditions of crowd-poisoning in camps, jails, ships, the proportions of an epidemic.

Ulcerative stomatitis begins almost suddenly with *pain, fetor, and salivation.* The excessive fetor is characteristic. The gums about the ulcer grow tender and bleed. These symptoms, with the appearance and situation of the lesion, make the diagnosis plain. The prognosis is for the most part favorable. Abstention from tobacco, alcohol, or other bad habits, from mercury or other drugs, quickly stops a toxic stomatitis.

Thrush and actinomycosis have been already described.

APHTHA.

Aphtha (*ἀφθαι, ἅπτω,* to inflame).—An acute infection of the mucous membrane of the mouth in children, attended or preceded by fever and general distress, caused probably by a staphylococcus (citreus and flavus, E. Fränkel; vide Foot and Mouth Disease), characterized by the formation of *small pin-head* or larger *scattered superficial grayish spots bordered with a bright-red line.* The disease occurs most frequently in the second year of life, and is rare after the age of six. It is especially frequent in orphan asylums, tenement houses, etc., where it may assume in its successive, not simultaneous, attack of the inmates something of the proportions of an endemic. It is entirely independent of, though often coincident with, dentition.

The prodromal fever is sometimes high, and the cause of it is discovered often only by that general inspection which leads to the examination of the whole body, including the throat.

The mucosa of the mouth shows more or less diffuse redness; the glands about the neck may be swollen. The eruption—ten to twenty spots in all—appears in the course of a day or two anywhere in the mouth, but with especial predilection for the tip and borders of the tongue, sides of the frenum linguæ, gums, cheeks, lips, and palate. More rarely the characteristic spots may be seen upon the posterior wall of the pharynx and tonsils. The eruption is a fibrinous exudation with subsequent necrosis of epithelium. Denudation of the epithelium makes the mouth sensitive and sore; salivation may be profuse, and nutrition may be impaired through difficulty (pain) in

nursing. Individual spots heal from the periphery by gradual contraction of the red border to the centre. Each spot lasts five to six days, the whole eruption with its successive crops ten to twelve days, leaving at first slight depressions of lighter color, never any real cicatrices, with final complete restoration of tissue.

Diagnosis.—Aphtha is distinguished from traumatic lesions of the mouth, as from sharp teeth, pertussis, erosions, etc., from burns, tuberculous, syphilitic processes, etc., besides by the site of aphtha, by the fact that the eruption is scattered, isolated, circumscribed, and bordered with a bright-red line. So also are separated forms of stomatitis. Aphtha never shows real ulcers and is not of itself attended with fetor oris—facts which distinguish it from ulcerative stomatitis. Thrush is a separable curd or deposit, often of great extent, on the surface, and hence easily separable from aphtha. Since the special form of aphtha known as Bednar's aphtha, which consists of erosions or ulceration on each side of the raphe of the hard palate close to the alveolar border, has been demonstrated to be due to injury inflicted by the fingers and cloths in the act of cleaning the mouth (Baumm, Epstein), and not to sucking lesions or to syphilis as formerly believed, the condition has lost all pathological interest. The same remark applies also to the miliary eruption, "epithelial pearls" (Epstein), which shows itself *directly and only in the line of the raphe*, as yellowish, round, prominent bodies of the size of a pin's head, and which has been demonstrated to be normal growths in congenital clefts. The slight ulcers which result from accidental breaks of the surface speedily heal.

Bednar's aphtha is obviated by avoiding the roof of the mouth altogether in washing out the mouth.

Treatment.—Most cases of sore mouth in infancy can be prevented by cleanliness of breasts, artificial nipples, feeding bottles, etc. Inspection of dairies and occasional testing of milk itself by competent sanitary officers best secure purity for this staple food. Attention to the first teeth, especially to carious teeth, the early use of the brush—these are points of the first order in prophylaxis. Mouth washes of borax, a teaspoonful to a glass of water, or boric acid with glycerin and water, secure asepsis as well as antisepsis. Spongy gums are best treated with daily brushing or pencilling with tincture of myrrh or of rhubarb, the root of which chewed is also an effective and, to many, pleasant astringent. The standard remedies in the treatment of all forms of sore mouth are nitrate of silver and chlorate of potash. Ulcers or abrasions of stomatitis are lightly touched with the stick once a day or every other day. The albuminate of silver which thus coats the surface protects it from further insult or injury, and the healing process goes on beneath. The chlo-

rate of potash is best given internally, that it may come in more constant contact with the parts in its continuous elimination by the saliva. A teaspoonful of a saturated solution in peppermint water every two hours is maximum dosage. The dose of the chlorate should not exceed one or two drachms per day to an adult. The permanganate of potash ranks high as a mouth wash or local application with a camel's-hair brush in the proportion of 1 : 100. It is especially useful in ulcerative forms with excessive fetor. Thymol gr. xv., alcohol, aqua āā ℥ ij., makes a good purifying mouth wash. Mercurial stomatitis is best treated by thorough cleansing with a cotton-wrapped sound. The cotton is to be carried along the edge of the gums and inserted between the teeth, especially the back teeth, where the process, as determined by gravity in the night, commences. Hereupon the gums and spaces between the teeth are to be treated with a concentrated solution of chromic acid. In sensitive subjects the treatment may be preceded by an application of cocaine, ten per cent. Feibes, who first used this treatment, recommends also a tooth powder, especially under mercurial treatment:

℞ Calcii carbonatis præcipitati,
Lapidis pumicis subtile pulveris,
Potassii chloratis,
Cinchonæ rubræ corticis pulveris..... āā 16.0
Rhei radicis pulveris..... 10.0
Saponis puri..... 23.0
Olei menthæ piperitæ..... 3.0
M. Ft. pulveres subtiles terendo.

As a gargle:

℞ Solutionis alumini acetatis..... 10.0 : 200.0
Aquæ florium aurantii..... 200.0
M. S. One tablespoonful in a glass of water as a gargle every half-hour.

Noma, a gangrene of the cheek, attended with the most profound destruction and horrible deformity, is fortunately a very rare (22 cases in 8,286 patients, Woronichin) condition. It occurs mostly between the ages of two and seven, next among soldiers. It is found, as a rule, only under the most degraded surroundings, usually in the course of one of the infections, chiefly measles, typhoid fever, small-pox, sometimes whooping cough, and syphilis and rickets, and in connection with thrombotic occlusion of vessels. It is fatal by sepsis in three-fourths of all cases. It must be attacked with carbolic acid, concentrated solutions, with corrosive sublimate, or with actual fire, Paquelin's thermo-cautery, ferrum candens, galvano-caustic wire.

The *coat of the tongue* has less significance in our day. A healthy tongue is always more or less coated in its posterior third. The coat is, with epithelial débris, a mass of micro-organisms, of

which the mouth is a reservoir. A perfectly clean condition from front to rear is not a sign of health. The coat of the tongue is an evi-

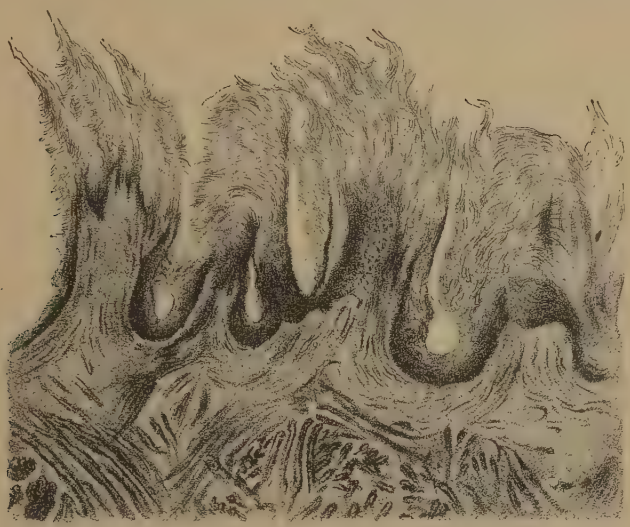


FIG. 173.—The tongue coated white, moist. Section from case of granular kidney (Dickinson).

dence rather of the condition of its mucous membrane, with reference more particularly to exfoliation and detachment of foreign matter.

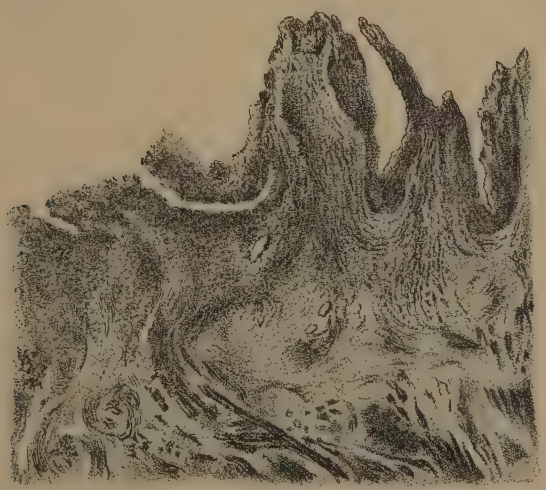


FIG. 174.—The tongue denuded, red, and dry (raw-beef tongue). Section from case of peritonitis (Dickinson).

A healthy tongue sheds its coat so continuously as to prevent accumulation. Interruptions of the circulation which impair its nutri-

tion, in infectious diseases, for instance, or in any cachexia, interfere with this process and lead to a coated tongue. The coat of the tongue is therefore not so much an indication of the condition of the stomach as is commonly believed. Nevertheless the condition of the tongue is an index of disease.

The tongue shows a difference also in dryness. Ordinarily it is moist. The extraordinary pliability of the tongue is due largely to its humidity. Where the nose is occluded, as by catarrh, polypi, etc., and breathing takes place by the mouth, the tongue becomes dry, its movements inhibited, even its protrusion from the mouth difficult or impossible. When the uncoated tongue becomes dry it assumes a glazed and horny appearance. The coated tongue, dry, shows a brown or blackish crust, which leads to the formation of crusts and fissures, whence blood may exude to become inspissated, to make of the organ an indurated, immobile mass. A peculiar "black tongue" is caused by certain fungi.

ANGINA.

Angina (ἄγχω, to choke).—A term applied to all kinds of affections of the fauces, pharynx, and throat attended with pain, dysphagia, and dyspnœa, but more strictly limited at the present time to affections of the fauces and tonsils. Aside from the sore throat produced by specific diseases—scarlet fever, diphtheria, syphilis, tuberculosis, scurvy, etc.—forms of angina are described of the fauces as catarrhal, rheumatic, herpetic; of the tonsils as lacunar, follicular, phlegmonous; of the whole throat as septic, gangrenous, erysipelatous, etc. A special form which emanates from the mouth, salivary ducts and glands, and involves the whole mass of tissue composing the floor of the mouth and upper throat, is set apart and distinguished as angina Ludovici. Retropharyngeal abscess is also often erroneously included under the term angina.

The *tonsils* are the seat of frequent disease. Simple catarrhal inflammation expends itself upon the surface of the tonsils or extends to involve the soft parts in their immediate vicinity. Pain in the pharynx, tenderness to pressure, more or less difficulty with deglutition, are signs of this affection, which shows itself by increased swelling and redness on inspection. A special variety of tonsillitis is shown in the so-called follicular form, whereby the natural crypts or follicles are enlarged and contain caseous masses which, when removed, as by the finger nail, spoon handle, or point of the knife, emit upon pressure of the caseous mass an excessively fetid odor. In situ they often cause inflammation about them. They sometimes stick like a pin or a knife, unpleasant sensations which disappear with their removal. More extensive or deep-seated inflammation involving the structure

of the tonsil is shown in the suppurative or phlegmonous form. In these cases the tonsil enlarges to twice or thrice its natural size. It protrudes to partially block the throat, and shows itself as a hard swelling upon the outside of the neck. Inspection reveals this globular mass, which is more distinctly outlined by palpation between two fingers, one external, the other internal; and points of suppuration may be seen upon the surface of the tonsil, more especially in its posterior inferior region, or may be felt as a deep-seated fluctuation. Rupture which occurs naturally to discharge its contents, or incision which is made as soon as the condition is detected, cures the disease.

More protracted are the cases of *hypertrophy of the tonsils.* Repeated attacks of tonsillitis themselves leave the tonsils large. Life in a contaminated atmosphere, with its continual insults and more or less continual absorption of infected matter, eventually leads to permanent enlargement of the tonsils. Many children are born with large

FIG. 175.

FIG. 176.

FIG. 175.—Pharyngo-nasal catarrh. Physiognomy before removal of adenoid tissue (Buck).
FIG. 176.—Pharyngo-nasal catarrh. Physiognomy after removal of adenoid tissue (Buck).

tonsils, or seem to acquire the condition early—not the result necessarily of scrofula (tuberculosis), but as the result of the absorption of other or any poisons in the mouth into these first outlying lymphatic glands (Hodenpyl). In these cases the tonsils are often found so large as to nearly or even quite touch each other, so that a slight additional inflammation brings them together or largely occludes the fauces. Children who live in an atmosphere of infection, more especially by the streptococcus, or of tuberculosis or of the various exanthemata, for any length of time, become subjects of enlarged tonsils.

The condition seems in all cases to result from an absorption from the mouth and throat, and not from blood poisoning.

Chronic hypertrophy may oppress the circumjacent structures in the same way as in a case of quinsy. Thus there is often disturb-

ance of hearing from compression of the Eustachian tubes, or more especially from invasion of these tubes from the same infectious process. So, too, the nares may be blocked. The sense of smell is abolished; the child becomes a mouth-breather. The physiognomy then changes. The countenance is listless, the expression drooping and vacant, the special senses lose their keenness of perception. In adults the condition is wont to be associated with more or less melancholy. This hypochondriasis leads to frequent change of physicians, to the use of various nostrums, proprietary and patent medicines. In fact, pharyngeal or pharyngo-nasal catarrh, with which this condition is associated, is a special field for quackery, and from its mental associations has developed a specialty even in regular medicine. Excessive refinement has been reached in the study of these cases of pharyngeal catarrh. Surfaces from which the upper layer of the mucous membrane have been denuded appear glazed, shining, and dry. Thicker mucosæ show a more granulated or gelatinous appearance. Follicular affections show pinhead granules, sometimes painful, in the pharyngeal wall, on the palate, especially on the surface of the tonsils, where they may be seen as whitish masses from the size of a pinhead to a pea, which may be expressed by the finger nail or the handle or point of the scalpel, to liberate caseous particles of excessively offensive odor.

Another cause of occlusion, especially at the vault of the pharynx, is the formation of adenoid tissue, succulent masses of low vitality rich in lymph cells, rapid in growth, which spring from the posterior wall of the palate or vault of the pharynx, to at times occlude the posterior nares, alter the voice, and interfere with respiration. These are the cases in which are noticed the alterations of voice which produce the nasal twang. The change is noticed more especially with the articulation of certain letters, *m*, *n*, *ng*, to which are given a dead expression characteristic of the condition, on account of occlusion of the resonating cavities in and about the nose.

The *diagnosis* of the various forms of angina is made by simple inspection, by examination with the laryngoscopic and pharyngeal (rhinoscope) mirror. Palpation recognizes enlargement of lymphatic glands in the neck.

The *treatment* of acute angina consists in rest in a pure, warm atmosphere, and relief of pain by external application of heat, hot water, flannels, gargles of hot water, applications of cocaine four per-cent solutions, and the internal use of salicylic acid or salipyrin:

℞ Salipyrin ..... ℥ i.–ij.
Glycerinæ..... ℥ i.
Syrupi aurantii corticis..... ℥ ss.
Aquæ ..... ℥ iiss.
M. S. Dessertspoonful to tablespoonful every three or four hours.

One whole dose gr. x., or several broken doses of Dover's powder gr. iij., quickly relieve tension and pain. Inhalations of steam impregnated with carbonate of soda help also to relax tension and relieve pain. The lapse of a little time must be awaited with some patience in the resolution of an acute angina.

The *chronic hypertrophies* and catarrhs are treated best by astringent applications of alum and iron, ferric alum, gargles or sprays of the same materials, especially by the nitrate of silver of varying strength; more obstinate cases by parenchymatous injections into the tonsil, as of iodine, etc, applications to the surface of stronger caustics of London and Vienna paste and caustic potash. , By far the most effective remedy in the treatment of these conditions, whether of hypertrophied tonsils, exuberant mucosæ, or adenoid tissue, is the galvano-caustic wire. Either the hypertrophied tonsil is surrounded by a loop, which is gradually tightened, or by means of the knife, more particularly the guillotine, a slice of the tonsil is abstracted, whereupon the mass will usually undergo atrophy. The loop is also introduced into the interior meatus to destroy hyperplastic tissue in the nose, or, by means of the finger in the mouth, may be carried up about any adenoid tissue in the vault of the pharynx to successfully remove it. Or the galvano-caustic platinum spatula or plate may be brought to bear upon the mass *in situ* to effect, in the course of several sessions, its entire destruction.

The *Œsophagus* is seldom the seat of disease. Constituting, as it does, the avenue of entrance of all food and drink, and subjected to every possible variety of insult, it is surprising that it is not more often affected. The reason of the exemption lies probably in the rapidity of transit through the tube. The diseased condition most commonly encountered is the nervous contraction known as *globus hystericus*. This condition is supposed to result from an approximation by circular contraction of the œsophageal walls, and is one of the common expressions of *hysteria*. It is found, therefore, more frequently in hysterical patients, young females especially, in connection with emotional disturbance. It reveals itself often by the fact that more obstacle is offered to the deglutition of fluids than solids. Solids are swallowed easily, fluids are regurgitated. The condition is usually readily recognized by the passage of the stomach tube. Gentle and persistent effort will always overcome a spasmodic constriction.

Contraction of the lumen of the tube from other cause is the condition next most frequent. This contraction may be due to outside cause, as a goître, an aneurism, a tumor of the neck or chest; or it may be due to intrinsic cause, as to the cicatrization of an ulcer. It is most frequently due to *carcinoma*. Inasmuch as the œsophagus cannot be inspected or subjected to palpation, and inasmuch as œso-

phagoscopy is as yet entirely unsatisfactory, examination may be aided by auscultation. Auscultation along the left side of the vertebral column reveals in the act of deglutition a peculiar gurgling sound, which has been likened to that which is emitted by the fluid ejected from a syringe; while auscultation in the region of the sternum discloses a peculiar pressure sound several minutes later than the first sound. This second sound in the presence of obstruction may be absent altogether. Much more reliance is to be placed upon examination of the œsophagus with the stomach tube or œsophageal sound. In all cases examination should be made with the ordinary soft stomach tube first. It is impossible to do damage with this tube. The instrument is anointed with glycerin rather than with olive oil or vaselin, seized with the finger and thumb of the right hand, after the manner of holding a pen, while the left hand is introduced into the mouth of the patient seated in front of the physician, and as the end of the tube reaches the posterior pharyngeal wall the fingers of the left hand are depressed to turn the tube into the œsophagus. Once past the larynx, the tube glides readily to the stomach. The obstruction which is encountered opposite the larynx is natural. There should be encountered no obstruction in the further course of the tube. Should this soft tube fail to pass, recourse may then be had to the English sound of solid rubber or waxed silk, a thick, continuous rod, smaller at the end, which terminates in a bulbous enlargement. This tube may be rendered slightly softer by immersion in hot water, and is with much more ease introduced to the stomach. Finally, the whalebone sound, with its series of olive-shaped metal tips, may be substituted to push down the foreign body or to dilate a commencing stricture. Stricture from an ulcer usually results from an ingestion of an acrid poison, mineral acid, etc., and is encountered in the upper part of the œsophagus. Peptic ulcers are excessively rare in the œsophagus.

Cancer of the œsophagus is a not infrequent disease; it is the most frequent organic disease of the œsophagus. It is encountered for the most part after the middle period of life, in individuals who show more or less cancerous cachexia and complain of *pain with difficulty of deglutition or regurgitation* of solid food, which accumulates in the pouch above the stricture.

The seat of cancer is in the lower half of the œsophagus, more especially about the region of the cardiac orifice. It shows itself at first, as a rule, as a girdle-like stricture, to permit often the passage of the smaller sounds; often as an impermeable mass with a pouch above it, in which the softer tube rolls itself up to give the impression at times of penetration into the stomach. The treatment of can-

cer of the œsophagus impenetrable by the tube or sound does not differ from that of cancer of the pylorus.

Angina Ludovici starts from the submaxillary gland, whose tissue is invaded through its ducts by pyogenic micro-organisms. It occurs in connection with the infections, but arises oftener of itself. It distinguishes itself by the extent of its range and the severity of its inflammation. The region of the floor of the mouth, the whole lower jaw, sometimes the whole throat, forms a vast mass of board-like hardness. All the functions of the mouth are crippled. Compression of the great vessels in the neck may develop cyanosis of the face, insomnia, sometimes confusion of ideas and extreme general distress. With suppuration, which is often prefaced by surface œdema, sepsis may ensue, with chills, sweats, icterus, diarrhœa, petechiæ, joint affection, and other signs of streptococcus infection.

The *treatment* consists in applications of heat and moisture, free incision, with subsequent irrigation and disinfection of the cavity left.

Retropharyngeal abscess results from caries of the cervical vertebræ (tuberculosis), or, oftener, infection of lymph glands at the back of the throat. Infection is carried to the glands in front of the second and third cervical vertebræ from the nose and throat in the natural course of the circulation ; hence the connection between this abscess and diphtheria, scarlet fever, and erysipelas is easily understood. The abscess arises, however, for the most part independently of these diseases, as it occurs chiefly in childhood in the first year of life. It is rare after the age of five; in fact, the condition itself is quite rare, but is of importance from the fact that it is often overlooked, a negligence which has been punished with fatal results. A swelling in the back wall of the small throat of an infant blocks the throat, the posterior nose, the Eustachian tubes, and may infringe upon or produce œdema of the larynx. Rupture of the abscess, especially spontaneous rupture, may inundate the larynx, and, more likely in the night, drown the patient, or pus may burrow to the mediastinum and break its way into the pleura or pericardium. More rare are the cases in which the discharge finds vent in the parotid gland or on the surface at the angle of the jaw.

The abscess may develop rapidly in the course of a few days, or slowly in the course of weeks or months. Acute cases are attended with pain, dysphagia with regurgitation, and dyspnœa with snoring respiration. Hoarseness of voice (cry), signs of stenosis, cyanosis, swelling of the cervical veins, retraction of the chest, give proof of pressure upon the larynx. All the signs are easier under decubitus with the head retracted upon the spine, and are aggravated with flexion of the head upon the body. Inspection reveals a tumor, tough,

elastic, or fluctuating to touch. Aspiration may disclose the contents and character of the growth.

The *prognosis* is favorable if the disease be recognized early, and the abscess may be evacuated without danger to the larynx.

The *treatment* consists in the evacuation of the abscess, gradually if necessary in protection of the larynx, by means of an aspirator. The knife, wrapped nearly to the edge, must be used with caution to avoid wounding important vessels.

CHAPTER II.

DISEASES OF THE STOMACH.

GASTRIC CATARRH.

An affection of the mucous membrane and musculature of the stomach, acute and chronic, characterized by indigestion, defective secretion of gastric juice, excessive secretion of mucus, pain, nausea, vomiting, constipation, depression of spirits, atrophy of the mucosa, and marasmus.

Gastric catarrh was formerly known and described under the term gastritis. Gastritis is objectionable. It fails to localize the affection. Gastritis is used in our day to express a more intense or extensive inflammation of the stomach, that which results, for instance, from the ingestion of poisons, mineral acids, etc., which corrode and perforate the various coats of the stomach. Catarrh limits the disease to the mucous membrane. This term is also not unobjectionable, for it is especially a gastric catarrh which does not remain confined to the mucous membrane, but extends to and involves, at least produces paresis in, the muscular coat. On the other hand, as an advantage, the term catarrh implies an inflammation likewise of the various glands, mucous and peptic, of the stomach; for the stomach mucosa is not to be regarded as a mere surface membrane, but as an organ made up of closely apposed, deeply involuted glands. Ewald appropriately calls the disease a gastritis glandularis. Dyspepsia is only a symptom. Catarrh is everywhere a provisional term. Under catarrh is embraced that group of affections which cannot be accounted for by any specific process, ulcer, cancer, etc.

Etiology.—Gastric catarrh may be the expression of irritant ingesta, of an insult offered to the stomach in the food or drink. It results often from faulty habits of life, particularly with regard to food, quality, quantity, preparation, time of taking, etc. The action of the stomach is also strongly under nervous influence, so that catarrh may result from neuroses. A fruitful source of catarrh in our country is worry, business worry. Gastric catarrh is the result of causes both intrinsic and extrinsic. No mucous membrane is more

sensitive than that of the stomach. Many of the worst cases of gastric catarrh result from diseases of other organs, and the physician in the presence of gastric catarrh, more especially chronic gastric catarrh, must first of all eliminate disease of other organs. According to the intensity of the symptoms, or more especially the duration, catarrh is divided into the two forms, acute and chronic.

Acute catarrh finds its most frequent expression in infancy, and is the direct result of an offence, irritation, of the mucous membrane by improper food. The human race would long since have been reduced to very limited numbers were it not for the fact that the food of infancy is for the most part furnished fresh. Infants fed at the breast of healthy mothers seldom suffer acute catarrh. Overfeeding is attended with overflow; easy, natural vomiting, more in the way of regurgitation, relieves a distended stomach. How slight an effort is required to secure this relief is observed in the frequent vomiting which occurs in a well-fed child after the lightest pressure upon the stomach.

Gastric catarrh, more properly gastro-intestinal catarrh, is the most frequent and most fatal disease in childhood, especially in hot weather. The food of childhood, milk, from any outside source, is most prone to undergo decomposition. The poor have no ice chests and no provision for the preservation of milk. Consequently the poor not fed at the fountain of nature succumb in the heat of summer.

Acute gastric catarrh in adults is the result more frequently of insult to the stomach by improper or injudicious drinks. Not at all infrequently the fault lies with the drinking-water itself, which is contaminated by the discharges of disease, typhoid fever, dysentery, etc. Gastric and gastro-intestinal catarrh may be the means in these cases of eliminating causes of disease, which otherwise find lodgment to reproduce the disease itself. Individuals have been rescued from trichinosis by the copious vomiting which has discharged the infected food. Crude beer, sophisticated wines, drugged whiskey and brandy, etc., inflame the stomach to produce acute gastric catarrh. Improperly cooked foods may act at any time in this way.

Gastric catarrh belongs to all the acute infectious diseases. Anorexia, nausea, sometimes vomiting, announce the onset of these affections. An acute indigestion results at times from exposure to cold, as also from nervous emotions.

Chronic catarrh is for the most part an expression of an outside disease. At the head of this list of diseases stands tuberculosis. Many cases of tuberculosis are marked by a long-continued and obstinate dyspepsia. Gastric catarrh may exist in these cases for

months without suspicion of the existence of tuberculosis. It is plain to see that treatment addressed in this case to the stomach itself may bring little or no relief, whereas the condition may be made to disappear often promptly, sometimes permanently, by the recognition of its cause. Bright's disease is a fruitful factor of gastric catarrh. The lack of appetite and digestion contributes largely to the progressive degradation of physical and mental tone in these cases. The gastric catarrh is the direct effect of some toxic matter circulating in the blood, which matter the kidneys fail to eliminate. These cases are singularly obstinate, and yield only, if at all, by reference or address to the cause of the condition. Disturbance in the portal circulation, disease of the liver (cirrhosis), soon brings about a gastric catarrh. Constant reflux of bile, by neutralizing the acidity of the gastric juice, begets the changes of catarrh. Disease of the uterus or ovaries is a not infrequent cause of gastric catarrh. Dyspepsia may be the first sign of carcinoma or salpingitis. Prostatitis is the analogue in the other sex.

Gastric catarrh must be always carefully dissociated from ulcer and cancer of the stomach itself. This differentiation is often a nice problem in diagnosis. The fact is, both ulcer and cancer are, as a rule, associated with gastric catarrh.

Pathology.—Chronic gastric catarrh is in its essence a parenchymatous inflammation which results in a transformation of the protoplasm of the gland cells into mucus, with final atrophy of the cells and glands.

Symptoms.—Acute gastric catarrh announces itself with *pain*, more or less severe, in the region of the epigastrium. The pain is attended at times with *sinking sensations*, with actual *vertigo*. There is a *vertigo a stomacho læso*, which is often quickly relieved by the administration of a few grains of chloral to obtund the sensitiveness of the stomach nerves. *Vomiting* finally removes the acrid ingesta, to relieve the condition, at least for a time; and the true treatment of this condition is to quickly empty the stomach of its contents by the use of hot water or by the administration of a laxative, which may discharge the contents of the stomach into the intestine.

Chronic gastric catarrh has an extensive symptomatology. The pain of the chronic condition is not so acute, but it is more constant, and not so strictly dependent upon the taking of food, though it is always aggravated in this way. There is more or less *tenderness* to pressure over the region of the stomach in these cases. The stomach is frequently *distended with gas*, to show its enlarged outlines upon the surface to inspection or palpation. The distention is often so great as to impede respiration, or more frequently to inter-

fere with the action of the heart. Most attacks of simple *palpitation of the heart* are the expressions of an indigestion. Reflected acrid, burning pain in the course of the œsophagus is known as *heartburn.* Gas from the stomach escapes in *eructations,* which have often excessively fetid odor.

The disease is associated for the most part with *constipation,* and, in consequence of the constipation, with *hæmorrhoids.* In consequence also of the defect in digestion and absorption of gases into the blood there is poisoning of the nervous system. The energy is reduced. The victim of gastric catarrh has a disgust for life. He can accomplish nothing. Many patients are melancholic. More are *hypochondriacal.* Nearly all hypochondriacs are dyspeptics, and

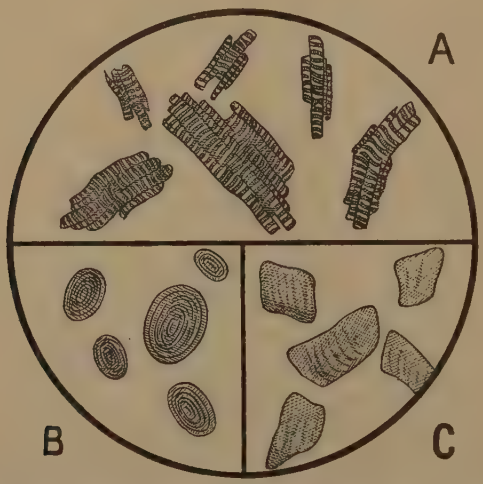


FIG. 177.—Action of the digestive juices: A, muscle fibre from the stomach; B, starch granules from the stomach; C, muscle fibre from the fæces (Wesener).

this often notwithstanding the fact that they may be great eaters. *Vomiting* is a frequent symptom, of the contents of the stomach, of large quantities of tough, glairy mucus, of foul, acid, and other products of fermentation, and of bile, along with masses of undigested food. Where the condition has existed for a long time, so that the submucous connective tissue has become hypertrophied, especially in the region of the pylorus, the stomach suffers distention to such extent as to simulate at times the gastrectasias of cancer, and to *discharge thus by vomiting enormous quantities* of accumulated matter.

The *diagnosis,* which is discussed later in connection with organic disease, is best established by means of the stomach tube. The

stomach tube gives information which surpasses in the exactness of its value that furnished by all other signs. The patient whose condition is to be investigated receives in the morning a meal consisting of a plate of soup, a biscuit, and a piece of beef. This food should disappear from the stomach in six or seven hours, so that the tube, introduced into the stomach at this time, should withdraw nothing more than a little mucus. In gastric catarrh, however, residue, sometimes in large amount, of undigested food escapes through the tube and may be submitted to further examination. It is observed then to what extent the muscular tissue is disintegrated and digested, how much the starch granules are eroded and destroyed, to what degree the fat globules are floated free. It is observed if fungi or bacteria be present in the mass, and the ejected matter is then subjected to chemical test.

FIG. 178.—The soft stomach tube with openings at the end and side, and with receiving glass funnel.

The information of most value in the study of diseases of the stomach is the recognition of the presence, amount, or absence of free hydrochloric acid. The presence or amount of pepsin is secondary. It corresponds for the most part to the hydrochloric acid. It will be remembered that hydrochloric acid is not secreted in any

FIG. 179.—Partially digested matter from the stomach: *a*, muscle fibre; *b*, white blood corpuscle; *c*, *c*, *c*, flat and cylindrical epithelium; *d*, starch corpuscles; *e*, fat globules; *f*, sarcina ventriculi; *g*, yeast ferment; *h*, *i*, cocci and bacilli (those near *h* were once found by Von Jaksch in a case of ileus, hence arising from the intestine); *k*, fat needles, connective tissue; *l*, vegetable cells (Von Jaksch).

appreciable amount in an empty stomach. It begins to be secreted with the process of digestion, but is at first combined with the alka-

lies in the food, and does not appear free until at the end of half or three-quarters of an hour. Now it shows itself in increasing abundance, to be present in greatest amount at the height of digestion at the end of four or five hours. In catarrh of the stomach the amount of hydrochloric acid is limited. Hydrochloric acid is limited (subacidity) when present in less than 0.06 per cent; it is increased (superacidity) when present in more than 0 24 per cent. The acid may be discovered free or in connection with other acids, lactic acid, acetic acid, butyric acid, etc., which hinder rather than help digestion. The excessively acid odor of vomited matter of gastric catarrh is no index of the amount of hydrochloric acid. Odor in these cases is due to acid fermentations, acetic, butyric, etc.—conditions which markedly interfere with digestion or are the expressions of impaired digestion.

The detection of free hydrochloric acid becomes a matter of supreme value when it is known that, as a rule, free hydrochloric acid is absent altogether in cancer, and present, though reduced in amount, in gastric catarrh. Free hydrochloric acid is absent or reduced, not on account of any neutralization by products of cancer, but on account of disease of the mucous membrane. It is absent or reduced also in amyloid degeneration, atrophy from any cause, debilitating disease. tuberculosis, Addison's disease, pernicious anæmia, all kinds of fever, etc.

Numerous tests have been devised for the recognition of the presence and amount of free hydrochloric acid. A common test is made with methyl violet. Two test tubes are half-filled with translucent solutions of methyl violet. To one are added a few drops of the filtered solution which escapes from the stomach tube. Free hydrochloric acid changes the violet to blue, and, if present in great amount, to green. Contrast is offered in the two tubes. The test is very simple, but is unfortunately not very reliable. The same discoloration results in the presence of much common salt, or the color may be concealed by products of digested albuminates, etc.

A very convenient method is offered with a piece of filter paper soaked in a saturated solution of 00-tropæolin. A drop of the filtrate is let fall upon the paper, which is then heated in a watch glass In the presence of free hydrochloric acid the paper becomes brown and, as it dries, lilac. The value of this test consists in the fact that lactic acid does not produce this result.

The best test is made with phloroglucin-vanillin—phloroglucin two parts, vanillin one part, absolute alcohol thirty parts (Günzburg). To two or three drops of this fluid is added an equal amount of the filtrate in a watch glass or porcelain dish, which is then heated. In the presence of free hydrochloric acid the fluid assumes a deep red

hue, in the absence of it a brown-red or brown. As the glass is heated and the acid fluid dries, streaks of crimson show themselves about the edge. The only fallacy that can occur in this test is that which will result after the ingestion of bad eggs, as it is invalidated by sulphuretted hydrogen. The phloroglucin-vanillin test will detect free hydrochloric acid in as small amount as 0.005 per 1,000. It is thus by far the most delicate and valuable test that can be employed, and its execution requires but a few minutes. This test fluid, fresh, has an odor of vanilla and a golden-yellow color. It must be kept from the light, which turns it brown.

Lactic acid is best disclosed by the test of Uffelmann. One or two drops of the solution of the chloride of iron added to about one hundred grammes of a two-per-cent solution of carbolic acid make a steel-blue mixture. To this fluid is added some of the filtered stomach juice. In the presence of lactic acid the solution becomes yellow, a yellowish-green. In the presence of hydrochloric acid it becomes clear like water. Uffelmann's test will detect 0.01 per 1,000 of lactic acid.

Acetic and butyric acids are readily recognized by their odor, which may be additionally developed by mixing the stomach fluid with ether and evaporating the ether. Despite the searching investigations of modern times (Boas, Sjöqvist), the physiological remains the best quantitative test for free hydrochloric acid. Cubes of albumen (boiled egg) are digested in test tubes in an oven and compared with the results of healthy digestion.

It is important to estimate the movement of the stomach, as movement constitutes an important factor in the digestive process.

An ingenious attempt to discover the activity of the stomach was suggested by Ewald, who administered salol in capsule and noted the time when the products of its decomposition should be discovered in the urine. Salol does not decompose in the stomach, but splits up into salicylic and carbolic acid in the intestine. Salicylic acid is recognized in the urine by the violet color which results after the addition of the chloride of iron. Ewald found the first positive reaction in health in a half to one hour after the drug had been taken; but there was so much irregularity about the period of its recognition in disease as to make it practically of little value. Pills of iodide of potash coated with keratin were then substituted, with the additional advantage that the absorption of the iodine could be determined by its appearance in the saliva. The patient expectorates upon starch paper every five minutes. The blue color is struck in health in fifteen to thirty minutes. A delay of one hour is evidence of disease. But this method also proved valueless in estimating motion, from the fact that the pills were sometimes dissolved in the stomach.

Sufficient information for all practical purposes can be obtained with the use of the stomach tube. Introduction of the stomach tube is for the most part an easy matter. It implies a certain degree of confidence which the physician may be able to inspire so that success may attend the first efforts. As a rule, strange to say, women succeed better than men. It not infrequently happens that the patient may succeed in the first effort where the physician fails. All patients succeed after repeated effort, so that the introduction becomes simple and easy.

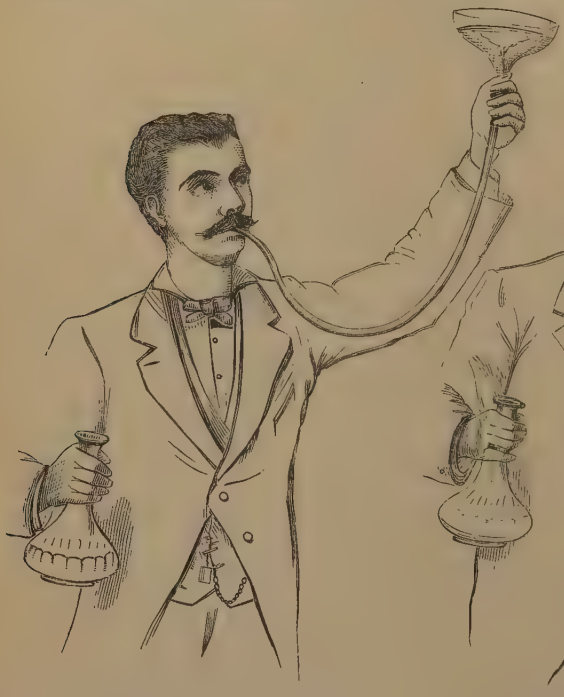


FIG. 180.—Irrigation of the stomach.

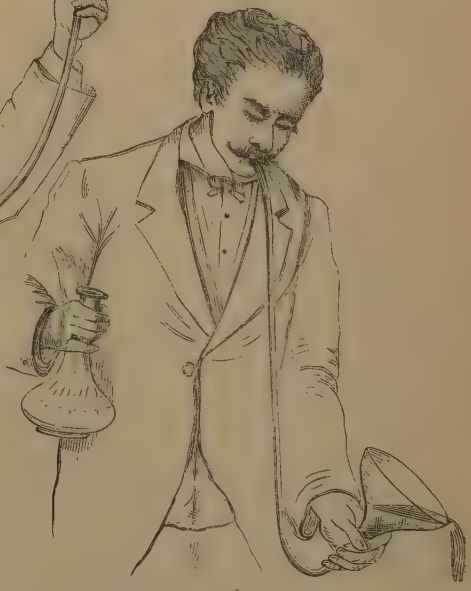


FIG. 181.—Discharge by siphonage.

Treatment.—An acute indigestion is treated, as stated, by emptying the stomach of its contents. The most effective as well as the safest way to treat poisoning is to wash out the stomach. Patients who would have survived poisons are sometimes killed by so-called antidotes. Where the patient is conscious this relief may be secured by the ingestion of large quantities of hot water. The water should be drunk until it is rejected, without reference to quantity, and the operation should be repeated, having due regard to the exhaustion of the patient, until the fluid escapes clear. Resort must be had at times to the stomach tube in the presence of unconsciousness, unwillingness, etc., but great care must be exercised with all hard tubes

to avoid perforation or inflammation of soft tissue. It is best in all cases to use the soft tube, which may be forced into the stomach, if necessary, by the aid of a gag and a catheter introduced into the eye of the stomach tube with a blind end, and withdrawn after the œsophagus has been fairly entered. Warm water is then to be poured into the funnel until the stomach is full, when the tube is quickly depressed and the stomach emptied by siphonage. Where there is any delay in the flow it may be facilitated by squeezing the tube between the thumb and fingers. The outside end of the tube may be inserted into a basin of water and slowly withdrawn toward the surface of the water, when the contents of the stomach soon begin to flow. Sometimes orifices in the tube become blocked by mixed particles of food, etc., to require some manipulation. Patients soon learn to handle the tube themselves. Where the tube is used as a remedial measure the stomach should be washed out once a day, preferably at night, whereby often substantial sleep of a whole night is secured. Ordinary gastric catarrh, even though chronic, may be successfully treated without the tube by regulation of the diet and by drugs.

The diet should commence with milk diluted one-half with imported Selters water. The milk may then be increased in strength, or it may be substituted by kumyss or egg largely diluted at first with hot water. In a day or two there may be added scraped or chopped beef with warm water and a little pepper and salt, mixed to the consistence of a thin mush; a tablespoonful of the meat mixture to be taken once or twice a day. In a few days more the patient may take the white meat of fish, sweetbreads, raw oysters, white meat of fowls, chopped steak, roast beef, and later bread, potatoes, and so on up to full diet, as described in detail later.

Of drugs, far and away the best is hydrochloric acid, gtt. v.–x. in a wineglass of water before meals. Next in value ranks arsenic, gtt. ii.–v. in a tablespoon of water after meals. The salicylates are especially adapted to cases in connection with gastralgia. The tincture of nux vomica gtt. x.–xx., solutions of strychnine gr. $\frac{1}{20}$–$\frac{1}{12}$, bitter tonics, Peruvian bark, the simple or compound tincture, give the stomach tone. The following formulæ from Ewald are fine bitters :

℞ Corticis condurango 25.0–30.0
Macera per horas xii. cum aqua..... 300.0
Digere lento calore ad colaturam..... 150.0

Adde
Acidi hydrochlorici diluti.... ..... 5.0
Syrupi zingiberis. .....ad 200.0
M. S. Tablespoonful every three hours.

℞ Tincturæ nucis vomicæ..... 5.0
Resorcin resublimati..... 10.0
Tincturæ gentianæ..... 25.0
Syrupi simplicis..... ad 200.0
M. S. Tablespoonful every two or three hours.

Laxatives—Carlsbad salts, a teaspoonful in a wineglass of hot water before breakfast; a compound rhubarb pill, one after each meal; a pill of podophyllin, gr. $\frac{1}{4}$–$\frac{1}{2}$, at bedtime; a tablet of cascara sagrada; a teaspoonful of a cascara mixture—suffice to relieve constipation. The antifermentative virtue of creosote has been remarked under tuberculosis.

ULCER.

Ulcus pepticum, rotundum, perforans, etc.—A disease whose lesion is a small, round ulcer with tendency to hæmorrhage and perforation; characterized by pain, dyspepsia, hyperacidity of the gastric juice, vomiting, hæmatemesis, peritonitis, and liability of relapse.

Ulcer of the stomach is a specific disease, quite different from an ulcer or a process of ulceration elsewhere. Ordinary ulceration may also affect the stomach, as the result, for instance, of the ingestion of irritants, mineral acids, or other poisons. Gastric ulcer distinguishes itself by its definite shape, size, location. It entails also certain complications and distinguishes itself by its tendency to relapse. Gastric ulcer is a frequent affection. It is a matter of surprise to those who are not familiar with the subject to learn that ulcer occurs or is found in five per cent of autopsies. The discovery of this condition so frequently is not so much a proof of the fact that the disease is sometimes latent, as of the fact that it is commonly confounded with gastric catarrh or is included under that vague, indefinite, and elastic symptom—dyspepsia.

History.—The lesion of the stomach in gastric ulcer is so gross that it could not fail to have been recognized by the earliest observers. Galen mentions it and prescribes the diet which is still maintained as the main element of treatment. He says the food should be glutinous. Acid and acrid substances must be avoided. Wine may be taken, but not too hot or too cold. Gratius (1695) saw an ulcer which perforated the stomach. There was adhesion to the spleen, which prevented the escape of the contents of the stomach into the peritoneal cavity. Littré (1704) discovered the source of a fatal hæmorrhage in a round ulcer of the stomach. Baillie (1793) spoke of the clean-cut edges, as if exsected by a knife. Abercrombie (1832) made important contributions to symptomatology. Cruveilhier (1830) first distinguished the disease from cancer. Rokitansky

pointed out the frequency of its occurrence. Virchow (1865) found the cause of certain ulcers in blocks in the circulation. From the investigation of several hundred cases Brinton was able to draw conclusions as to the location and to illuminate many of the signs of the disease. Finally, Leube (1875) found valuable evidence regarding the diagnosis from the use of the stomach tube, and furnished the best instructions in the way of feeding these cases.

Pathology.—Gastric ulcer is commonly known as the ulcus rotundum from its shape, and perforans from its tendency to erode the stomach walls. It is usually round or more or less elliptical and distinctly funnel-shaped, the orifice of the funnel being eccentrically situated at the site of a gastric vessel. Ulcers vary greatly in size, from a ten-cent piece up to the largest ulcers, of more irregular shape, resulting from the coalescence of two or more. Habershon described a case in which the ulcers or ulcerations reached from the pylorus nearly to the fundus. The ulcer is usually single. There may be a number in a single case. Wollmann once found eight. Lange found so many that "he gave up trying to count them." Ulcer of the stomach rarely coincides with ulcer of the duodenum or œsophagus. The edges of the ulcer, as stated, are clean-cut, as if removed by a punch (Rokitansky). Old ulcers, however, show indurations about their edges, to such extent at times as to have been taken for carcinomatous masses. It is the tendency of the gastric ulcer to perforate so that the base of the ulcer may involve only the mucosa, or the submucous connective tissue, or the muscular coat, or the peritoneal coat, which in turn may be perforated to permit the escape of the contents of the stomach. Not infrequently such accident is prevented by agglutinative inflammation with adhesion between the stomach and contiguous viscus, liver, spleen, pancreas, etc.

Gastric ulcers are situated, in the vast majority of cases, on the posterior wall—*i.e.*, on the lowest part of the stomach when the posture is erect. According to the statistics of Brinton and Rokitansky four-fifths of all cases are situated on the posterior wall, the lesser curvature, and the pylorus, so that the vast surface of the anterior wall, the great curvature, the fundus, and the cardiac orifice are comparatively rarely seats of the disease. The comparative exemption of the anterior wall is most fortunate, in that there is here no viscus to which the stomach can be tied or glued in case of perforation. The adhesions which do occur between the stomach and the abdominal wall are few and fragile, and are easily broken down. Ulcers, disclosed on autopsies, are found, of course, in every stage of ulceration or cicatrization. In fact, scars the results of ulcer are found in about half of all cases of gastric ulcer. The base of the

ulcer is usually covered with a gray slough. It may, however, be perfectly clean, as if dissected out. Sometimes the ulcerative process continues in the body of the viscus to which the stomach has become attached, and excavations, abscess formations, are thus found in the liver, spleen, pancreas, etc. More frequently fistulous communications with the colon, duodenum, or small intestine result. Adventitious sacs may be formed, subphrenic abscess, or perforations may occur externally or by burrowing sinuses at some distance from the seat of the disease.

Deformity of the stomach may result also from the process of cicatrization. The situation at the pylorus is thus peculiarly unfortunate, in that a cicatrix may contract the pylorus, to lead to more or less complete occlusion and gastrectasia, to simulate at times the condition produced by carcinoma. Hour-glass contractions about the centre of the stomach from girdled ulcers are curiosities occasionally encountered. The liability of hæmorrhage is another accident which gives gravity to this disease. The ulcer may open vessels of some size, most frequently the splenic artery, or blood may ooze in quantity from distended or varicose veins in the vicinity of or about the edges of the ulcer.

Etiology.—Ulcer of the stomach is a disease of adolescence rather than maturity and age. It is almost unknown before the age of ten. Among the cases collected by Brinton, but 0.08 per cent occurred under the age of ten. The disease begins to show itself about the period of puberty, and is encountered with especial frequency between the ages of fifteen and thirty. Sex has an important influence. According to all statisticians the disease is more frequent in the female sex; 2 : 1, 3 : 1 are the proportions usually observed. Ulcer of the stomach is noticed especially in connection with chlorosis, with anæmia, menstrual disturbance, hysterical states. In one-fifth of the cases the condition is found in connection with tuberculosis of the lungs; in two-thirds of the cases, according to Steiner, with diseases of the heart and vessels, endocarditis, endarteritis. Ulcer of the stomach, in consequence of thrombotic occlusion with destroyed blood corpuscles, is also found to occur as the result of burns of the skin, though not so frequently as ulcer of the duodenum.

The true cause of the condition is still obscure. It is generally attributed to the erosive action of the gastric juice, which does not attack the stomach wall in health, because the acid juice is neutralized by the alkaline blood. An interruption in the circulation which diminishes or withholds the blood supply permits the erosion. Cases have been observed in which embolus or thrombus, in connection with heart disease, atheroma, lues, has been observed, but in the majority of cases the cause eludes detection.

The revelations of the stomach tube have made it plain that in the majority of cases of ulcer the gastric juice is excessively acid. This hyperacidity is one of the points of differentiation between this disease and cancer. The ulcer has been attributed to the erosive power of this excessive acidity. It is difficult to understand why the ulcer should assume its particular shape under such action. Yet the situation of the ulcer at the surface of longest and closest contact with the stomach wall points to a development under destructive action. Panum found that he could produce hæmorrhagic erosion and ulcers of the stomach in animals by the injection into the arteries of insoluble particles. Ebstein and Schiff remarked that injuries of the nervous system, brain, and cord were attended with the same lesions. These accidents are due here, as in the case of burns, to thrombotic occlusions by dead blood corpuscles. Klebs calls in a spastic contraction of the arteries to account for certain cases, and Boettcher invokes the action of unknown micro-organisms. Virchow assumes that ulcer of the stomach may result from numerous causes. One may be, however, loath to accept such a view. The picture is so typical, the character of the ulcer so uniform, as to stamp the affection as an individual disease produced by a definite cause.

Symptoms.—Ulcer of the stomach is sometimes latent. Ulcers have been found upon autopsy without sign of existence in life. More frequently an ulcer has turned up to satisfactorily account for a long-continued and obstinate dyspepsia or gastric catarrh. As a rule the disease is announced with a distinct train of symptoms. *Pain* is almost universally present. It varies in character, is sometimes sharp, lancinating, sometimes dull, gnawing. A more characteristic feature is its more exact circumscription. The pain is located about the ensiform cartilage, at the umbilicus, in the back, at the middle of the dorsal vertebræ, or at the angle of the scapula. Wherever felt, it is *more or less localized* in this region in an individual case. Pressure upon the stomach rather intensifies than relieves pain. On the other hand, the pain is usually *modified* or abolished *by change of posture.* Individuals who feel pain only in lying upon the back or upon the left side, and who may be relieved by lying upon the face or the right side, are probably subjects of gastric ulcer. The situation of the ulcer may not be defined by the interval between the ingestion of food and the perception of pain. The pain does stand in relation to the taking of food—no food, no pain It sometimes occurs quickly, sometimes after the lapse of time. In a case recorded by Busch pain occurred in twelve minutes after the taking of food ; the ulcer was found in the duodenum ; while in the case of Pinel the pain was felt immediately, and the ulcer was found at the pylorus.

Vomiting is the next most frequent sign. It is present in three-fourths of the cases, and when absent is thought to be due to the location of the ulcer in exceptional places, as at the fundus, anterior wall, etc. Vomiting, which discharges the contents of the stomach, relieves the pain. It stands more directly in relation to the character of the food. Irritant foods inevitably produce pain and vomiting. The presence of both pain and vomiting does not distinguish gastric ulcer from gastric catarrh; but the vomited matter in gastric ulcer sometimes contains a distinctive feature in blood. *Hæmatemesis* is a valuable sign. It distinguishes itself in gastric ulcer, as a rule, by the *quantity* of the blood which is ejected. The physician is shown a basin or a bowl or a vessel filled with blood, and the patient is found exsanguine. Individuals have died of concealed hæmorrhage in cases which have thereby assumed juridical importance. The stomach has been found full of blood and the intestinal canal distended through its entire length. In many cases the blood is not vomited, but is discharged by the bowels. Hæmorrhage would be discovered more frequently if the stools were more closely inspected. Black, tarry matter is found in the discharges in these cases. In the experience of the author a mass of inspissated blood had to be removed at one time from the rectum with instruments several days after a hæmatemesis. Hæmorrhage is the most obtrusive sign of gastric ulcer. Unfortunately for the diagnostician, it is not present in even the majority of cases. It occurs in not quite one-half of the cases, and may be recognized when it occurs, in the absence of apparent blood, by faintness, nausea, vertigo, collapse, sometimes convulsions. Hæmorrhage is peculiarly liable to recur with the detachment of a clot which blocks the vessel.

Along with ulcer of the stomach is associated always that train of symptoms known under the term *dyspepsia*. There is anorexia, distaste for food, eructation of gas and fluids, heartburn, depression of spirits, and, in chronic or protracted cases, impairment of nutrition. On the other hand, many cases show a *bien-être*. The author had under observation the case of a man whose weight varied little from two hundred and fifty pounds. In this case signs of ulcer showed themselves with every dissipation. The signs included hæmorrhage, which at last proved fatal. *Constipation* is marked, as a rule, and is frequently obstinate.

The excess of hydrochloric acid in the gastric juice consumes the chlorides, so that the *urine is distinguished by absence of chlorides* and increase of alkalinity. The test made by a solution of silver nitrate is very easy and very valuable.

The *duration* of the disease is indefinite. Brinton recorded a case which lasted thirty-five years. The usual history is one of recovery

with cicatrization, reopening of the cicatrix after some insult to the stomach, and a repetition of the symptoms. It is, however, true that the majority of cases recover permanently after a single attack. The *prognosis*, on account of the possibility of perforation, is always grave.

The *diagnosis* rests upon the age, sex, history of previous attack, dyspepsia, pain, vomiting, hæmatemesis. The diagnosis is often very easy, especially in the presence of copious hæmorrhage. The only disease which simulates ulcer in this regard is cirrhosis of the liver, in which hæmorrhage is frequently profuse and not infrequently fatal. Cirrhosis hepatis is rare. It is a disease of the male sex in the vast majority of cases. It results from alcohol and is associated with other signs, dropsy, enlarged veins, marasmus, etc. The differentiation of diseases of the stomach from each other is discussed later. It is in this connection that the diagnosis is difficult, sometimes actually impossible.

Treatment.—The best food is milk when it can be borne, later beef or beef-pancreas emulsion. Starchy food must be avoided, as, while meat is well digested, starch is not attacked. Hæmatemesis is an absolute contra-indication of all food by the mouth. Support for a few days may be had by the rectum (see Food). In the presence of copious hæmorrhage an ice bag is put at the epigastrium. Ergotin may be injected subcutaneously or sclerotinic acid in syringeful doses. Pain may be controlled by bismuth gr. x.–xx. every two hours, or nitrate of silver gr. $\frac{1}{6}$–$\frac{1}{4}$, or chloroform gtt. v. in a tablespoonful of water, or cherry-laurel water ʒ i., or morphia gr. $\frac{1}{8}$–$\frac{1}{6}$. Constipation is best relieved by Carlsbad salts, a teaspoonful in a glass of hot water before breakfast, or more safely in recent cases by enemata. Perforation calls for laparotomy, already successfully performed by Parsons. The most essential factors in treatment are rest, abstinence from food, and time. As Jürgensen says, for ulcer of the stomach "hunger is the best cook and cure."

CANCER.

Carcinoma (*καρκίνος*, cancer, crab).—An epithelial overgrowth, probably caused by protozoa, in the region chiefly of the pylorus, which orifice becomes blocked; characterized by pain, dyspepsia, diminution of secretion of hydrochloric acid and pepsin, vomiting of food, mucus, disorganized blood (coffee grounds), tumor, with progressive emaciation, and death by inanition.

History.—Up to the time of Morgagni (1760) cancer was called scirrhus (*σκίρος*, induration), and only that form of it which broke the surface to cause or show ulceration was known as cancer. The term scirrhus had reference only to hardness of structure. The

fact that cancer shows itself in various forms in the body is an acquisition of later date. Laennec (1812) first set apart the brain-like, encephaloid form. Otto (1816) recognized a peculiar gelatiniform degeneration that takes place in other forms, which he distinguished as colloid cancer. Rheinhardt (1851) discovered the form commonly known in other places as epithelioma. The absence of free hydrochloric acid in cancer was first utilized in diagnosis by R. v. d. Velden (1871), though the fact was really first observed by Golding Bird (1842).

Pathology and Etiology.—Up to this time it was believed that cancer might develop in any kind of tissue, but Thiersch (1861) and Waldeyer (1867) demonstrated that cancer is an epithelial growth, and that the varieties in density are largely due to the amount of connective tissue which constitutes the stroma of the growth. Nothing more definite is known of the nature of cancer of the stomach than of cancer elsewhere. The tendency at the present time is to regard cancer as an epithelial cell containing corpuscular elements, which are parasites (protozoa) or degenerated protoplasm or granules. These corpuscular elements transmit or disseminate the disease. They take root and grow in the new soil, extending like a living thing by continuity and contiguity of structure.

It is universally recognized that the stomach is one of the most, if not the most frequent seat of primary cancer. The uterus is the only organ in the body which may dispute the field with the stomach. Tanchou found the uterus affected more frequently than the stomach by about seven per cent. Virchow gives the preference to the stomach. Welch, who makes his computation from 31,482 cases, puts the percentage for the stomach at 21.4, for the uterus 29.5—that is, rather more than one-fifth of all primary cancers affect the stomach, somewhat less than one-third the uterus. Cancer of the stomach is, therefore, a frequent disease, though it is by no means as frequent as ulcer. Statistics with regard to the frequency with which cancer is found on autopsy vary from one-half to three and one-half per cent. It is claimed that one one-hundredths of deaths from twenty years up are caused by cancer. Sex shows no difference. The predominance of males in hospital practice is due to the fact that males predominate at hospitals. Age has a most important influence. Steiner and Neureutter failed to discover a single case in two thousand autopsies of children. What cases have been reported under the age of twenty must be regarded with suspicion until the nature of the affection has been verified by the microscope. Some of these cases were undoubtedly sarcomata. Cancer occurs with increasing frequency in advancing age. According to the statistics of Brinton three-fourths of patients are between forty and seventy, two-sevenths between fifty and sixty. The re-

duction in frequency after sixty is apparent and not real, and is due to the fact that few survive this age. In these statements the fact must not be ignored that cancer has been not infrequently found between the ages of twenty and thirty.

It has been claimed that cancer of the stomach is less frequent in tropical countries. From lack of definite data these statements must be accepted with caution. Welch declares that, from his analysis of 7,518 deaths among negroes, he finds the proportion one-third less than among whites. The rôle of heredity, formerly considered so important, has been reduced to insignificance in our day. Cancer is found in the ancestry of but fourteen per cent of cases—an infrequency which makes a coincidence rather than a cause.

When cancer affects the stomach it is situated, as a rule, at the pylorus. Of the three hundred and sixty cases of Brinton, the pylorus was the seat of the disease in sixty, the cardiac orifice in but ten per cent. Eisenhart reports eighty-one cases, forty-four at the pylorus. Exceptional cases are found in other parts of the stomach. Cancer is seated at the orifices of the stomach in seventy-five per cent of cases—a contrast with ulcer, which is located at the orifices in but sixteen per cent of cases. Usually the disease is located as a mass or tumor which can for the most part be felt at the pylorus, whence it may extend to involve other parts of the stomach. In exceptional cases the cancer may diffuse itself more or less extensively over the anterior wall. It is in the vast majority of cases primary in the stomach. Where the disease has existed for any length of time it develops secondary deposits, first in frequency in the liver, which is found affected in one-fourth of all the cases; next in the peritoneum, then in the lungs, retroperitoneal glands, intestines, ovaries, etc.

The most important questions in etiology revolve about the connection between cancer and catarrh. It is certainly true that in most cases cancer is associated with gastric catarrh, that the symptoms of gastric catarrh belong to the symptomatology of cancer. It is, however, also true that in the majority of cases a diagnosis of cancer may be established at the start—that is. with the occurrence of dyspepsia. It is always impossible to know just when a cancer commences. The point of the utmost practical importance is the establishment of the exact relationship between cancer and catarrh. Cancer develops occasionally, but only exceptionally, in the borders of an ulcer, probably, however, only as a mere coincidence.

May cancer of the stomach be prevented by arrest of gastric catarrh? It is impossible as yet to determine this question. Cancer is probably *sui generis*. Certain it is that cancer occurs among individuals, seemingly in perfect health, who have subjected the stomach

to no abuse either with food or drink, while individuals who abuse the stomach in every way may remain exempt. No circumstance in the way of social standing, avocation, mental distress, or other surrounding seems to show any genetic relationship to the disease. When it is stated by the authorities that individuals who show cancer have had a predisposition to the disease, it may be seen to what extremity the pathologist is reduced in etiology.

Symptoms.—Cancer of the stomach is often *latent*, and masses as big as the fist have been disclosed upon the post-mortem table whose existence was unsuspected in life. Siewecke collected one hundred and twelve cases without typical signs. It need scarcely be stated that these masses were situated away from the orifices of the stomach. Cancer shows signs early, as a rule, because it affects these orifices. As a rule the disease shows itself with a train of distinct symptoms. *Pain* is present in nearly all cases. It is usually a dull, dragging sensation with epigastric distress. It may be felt most intensely in the back, about the vertebræ or the scapula, or lower down in front at the umbilicus, or at the pubes in cases of dislocated pylorus. The pain of cancer is usually due to indigestion, and not infrequently to gaseous distention. It does not stand in such intimate relation to the taking of food as in gastric ulcer. It may occur only as a vague distress as the stomach becomes more and more full toward evening, and show itself in intensity throughout the night. Proof of this lies in the fact that it nearly always disappears when the stomach is emptied, naturally or artificially. The pain is usually prevented and a night's sleep secured by washing out the stomach in the evening. It may, however, be due to direct pressure of the carcinomatous mass upon nerve fibres, or exposure of these fibres in ulcerative processes, as in the case of gastric ulcer. Pain may be entirely absent throughout the whole history of the disease; in fact, in eight per cent of all the cases. It happens occasionally, but very exceptionally, that a case presents all the other symptoms of cancer, including the tumor, but shows no pain. The aged especially feel no pain. Along with the pain are usually associated other symptoms of indigestion.

Cancer shows *dyspepsia* early, as a rule. It literally ruins the appetite from the start. Cancer poisons the blood and brings about early degradation of the mind and body. Feltz found the urine of cancerous patients more toxic than that of healthy patients. Klemperer observed that the injection of blood serum of cancerous patients into a dog brought about a quicker decomposition of the albumen, and Gros saw a foudroyant septicæmia supervene after the breaking down (softening) of a cancerous gland. *Vomiting* soon sets in, especially if the disease be situated at the pylorus. It may be due to

mechanical obstruction, which leads to gastrectasia and accumulation of food, mucus, detritus, until its final ejection *en masse* in large quantity. The discharge by *vomiting of immense quantities*, basinfuls, of fluid once a day or once in two or three days, should excite the suspicion of *dilatation of the stomach*, the most frequent cause of which is cancer. This dilatation is discovered, also, often by percussion, which reveals dulness over an increased area; not infrequently by palpation, which, when practised with alternate hands, may give rise to a sense of *succussion*, a peculiar fluctuation caused by the presence of fluid and gas—what the Germans call a *Schwappen-gefühl*. Vomiting may occur early,

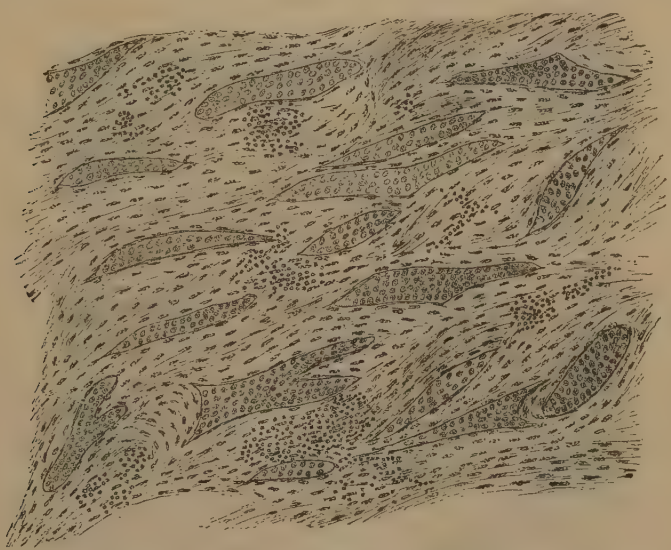


FIG. 182.—Microscopic appearance of section of scirrhus carcinoma (Councilman).

though the deposit of cancer be small. It may irritate the pylorus and lead to spastic contraction. Carcinoma at the cardiac orifice leads to vomiting early by irritative process, or, when pronounced, to regurgitation before the fluid has entered the stomach. Vomiting may be entirely absent in cases where the cancer is seated elsewhere than at the orifices—according to Lebert, in one-fifth; to Brinton, in one-eighth; to Ewald, in but one-twelfth of all the cases.

Vomited matter, aside from its quantity, may reveal the nature of the disease by its character. Thus Rosenbach was able to diagnosticate cases from *fragments withdrawn by the stomach tube.* The vomited matter at times contains *blood.* Hæmorrhage from the stomach is not so frequent or so copious in cancer as in ulcer. The blood is, as a rule, poured out into the stomach more slowly in

cancer. Acted upon by the gastric juice, it is disintegrated to show itself as coffee-ground matter. *Vomiting of coffee ground matter* is regarded as valuable evidence of cancer. Hæmorrhage is copious in but twelve per cent of cases. In these cases, however, it may so closely simulate ulcer as to necessitate appeal to other signs in diagnosis.

Blood may be recognized visibly, or by the microscope, or by Teichmann's chemical test. The following is Teichmann's test as given by Vierordt: Some of the coffee-ground material is filtered; a little of this matter is evaporated in a watch glass. Scrape off some of the dried material, mix it with a trace of finely pulverized salt, place the dried mixture upon an object glass, cover it with a glass

FIG. 183.—Hæmin crystals obtained by Teichmann's test, enlarged 300 times.

cover, and allow one or two drops of glacial acetic acid to flow under it; then the acetic acid is again evaporated very slowly, and, after it is thoroughly dry, one or two drops of distilled water are allowed to flow under to dissolve any crystals of salt that may be present. Under the microscope there can be seen crystals of hæmin (hydrochlorate of hæmatin) in coffee-brown or reddish-brown crystals in rhombic plates, which must be considerably magnified, as the crystals are very small.

The following method (an adaptation to the vomit of Heller's test for blood-coloring material in the urine, which see) leads to a result more quickly: Place some of the filtered stomach fluid in a reagent glass with a like quantity of normal urine, make it strongly alkaline

with liquor potassæ, and heat it. The urine phosphates are precipitated and carry with them the coloring material of the blood, to show, when blood is present, a cloudy, flocculent, reddish-brown deposit.

The most reliable evidence of cancer is furnished by the detection of a *tumor*. Tumor, at least localized induration, occurs in all cases, but may not assume sufficient magnitude to be detected in every case. In fact, taking the history of cases from beginning to end, the tumor is actually found in but eighty per cent of cases. In one-fifth of the cases of gastric cancer the diagnosis must be made without tumor. When present it is found in the majority of cases at the pylorus, the situation of which, however, is by no means always the same. The pylorus is very apt to be dislocated by the weight or growth of a cancer. Brinton calls attention to the transverse line midway between the ensiform cartilage and the umbilicus. The tumor is found in the majority of cases above this line in males, below it in females. It is at times recognized below the umbilicus, and very exceptionally, as stated, as low as the pubes. It is important not to mistake the lobe of the liver, the head of the pancreas, a rigid rectus, a distended colon, or other mass for a carcinoma. These things may be excluded only by careful examination. It is of supreme value to be able to feel the tumor when present. The patient must often be put in various positions, on the right or left side, in the knee-elbow posture. The pylorus has a way of hiding itself behind the ribs, behind the liver, whence it may be dislodged at times by distention of the stomach. Wagner has suggested and used the method of inflation by means of a seidlitz powder. The bicarbonate of soda, twenty or thirty grains, is dissolved in one glass of water, ten or fifteen grains of tartaric acid in another glass, and the glasses are taken separately. Or, better, the powders are swallowed dry with sufficient water to dissolve them, whereupon the stomach becomes distended, to show at times peristaltic movements through an attenuated or emaciated abdomen, or to dislodge the mass at the pylorus that may be felt. Runeberg accomplishes the same object by distending the stomach with air by means of a common air balloon or through the stomach tube. Affections of the colon may be differentiated by distention of the intestine with water or gas.

Up to the last decade it was maintained that the tumor formed the most valuable evidence of cancer. It is, however, by no means pathognomonic. In the first place, the tumor may not concern the stomach; in the second place, a tumor of the stomach may be benign. The discovery by Van der Velden, 1871, of the *absence of free hydrochloric acid* in cases of gastric cancer was hailed with acclamation. The discovery was made with the claim that the acid is absent in cancer, present in ulcer and catarrh. The claim has

since met with modification. It is known that exceptional cases of carcinoma show free hydrochloric acid, and that free hydrochloric acid may be absent also in cases of catarrh, or more especially degenerations other than cancer. Nevertheless it is true that the acid is absent as a rule in cancer, but is present as a rule in ulcer in excess, in catarrh in reduced amount, so that at the present time it may be declared that the persistent absence of free hydrochloric acid speaks strongly for carcinoma. Riegel considers the sign more valuable than the tumor. Probably few clinicians will coincide with him to this extent. The tests for free hydrochloric acid have been described in connection with catarrh of the stomach. There may or may not be much *loss of nutrition*. As a rule the strength fails with the loss of flesh, and the *progressive emaciation and prostration* are to be attributed partly to anorexia, mainly to dyspepsia in its true sense, somewhat also to infection of the blood. Exceptional cases preserve weight up to the last days of the disease. As a rule the degradation is marked by *cachexia*. With the progressive loss of weight there is corresponding depression of spirits. The expression becomes listless, melancholic. The face assumes a greenish-yellow tinge, the tongue is coated. There is œdema of the ankles and progressive marasmus.

The *diagnosis*, which is studied more closely later, rests upon the age, *absence of hydrochloric acid* on account of disease of the mucous membrane, pain, vomiting, especially of large quantities, or of coffee-ground matter, *tumor*, progressive course, etc. The presence of sixty per cent hæmoglobin excludes cancer (Häberlin), and thus distinguishes cancer from pernicious anemia, which shows absence of HCl, but increase of hæmoglobin (Mouisset). But the same blood changes found in cancer are sometimes seen in ulcer (Osterspey).

It is impossible to fix the *duration* of cancer, because the date of origin may not be established. An average case lasts from six to fifteen months. The general duration ranges from one to three years. Cancer may become quiescent. The patient often succumbs to metastatic deposits, especially in the liver. Sudden coma may supervene, as in diabetes, from diminished alkalescence of the blood and development of oxybutyric acid, or from absorption of toxic products (gases, etc.) in the stomach. The *prognosis* is fatal.

The *treatment* is wholly symptomatic. The daily or nightly use of the stomach tube gives the most relief. An early diagnosis—*i.e.*, before implication of the liver or metastatic deposits—justifies the use of the knife, which is, of course, a confession of despair. Condurango prolongs life. Opium secures euthanasia. Hope lies in etiology and prophylaxis.

GASTRECTASIA.

Gastrectasia (γαστήρ, stomach, ἔκτασις, dilatation).—Dilatation of the stomach results most frequently from occlusion of the pylorus, and occlusion of the pylorus is caused, in the majority of cases, by cancer. The block is mechanical, but before the mass accumulates to such extent as to completely occlude the pyloric orifice it is shut off by spastic contraction of its muscle under irritation of the altered contents of the stomach as well as of the growth itself. It is, however, a serious and not uncommon mistake to assume that every case of dilatation depends upon cancer. Certain cases are caused by the constriction of cicatrices from ulcers. The pylorus is a favorite site of ulcer, and the coalescence of two or more ulcers may make something of a girdle, the cicatrization of which may close the gate. So the pylorus may be blocked by outside cause, as by an impacted gall stone, tumor, aneurism, abscess, as of the vertebræ, etc.

Independently of any occlusion of the pylorus, dilatation of the stomach may be due to intrinsic cause, more especially to paresis of the stomach wall, the result most frequently of a chronic gastric catarrh. Affection of a mucous membrane for any length of time involves, in the course of time, the submucous muscular coat. It loses tone, it fails to empty the stomach, and, even when hypertrophied as the first result of an occlusion of the pylorus, it must subsequently become weakened, degenerated, overcome. Fatty degeneration, extensive atheroma, more especially amyloid degeneration, lead also to dilatation. In undergoing dilatation the stomach increases in all its diameters. The fundus fills the left hypochondrium, the great curvature extends to and below the umbilicus, the pylorus reaches over into the right hypochondrium. There is frequently direct interference with the action of the diaphragm and the heart. The increase in size of the stomach is recognized in emaciated subjects by inspection. It may be brought out more distinctly by inflation of the stomach with air, or with carbonic acid gas in the manner already described. So, too, the body of the stomach and its outlines become evident to percussion. There is increased dulness, increased tympanites, as the stomach is more or less full of fluid or gas in every direction. It seems often as if the stomach fills the upper half of the abdominal cavity, or comes to lie diagonally across it in cases of downward dislocation of the pylorus. Palpation distinguishes often a kind of fluctuation, due to the presence of water and gas, and a sort of succussion—*Klatschgeräusch*—a very valuable sign. On introducing the stomach tube it seems impossible to find bottom, it extends so much further than in a healthy stomach.

Suspicion is frequently excited as to the existence of this condi-

tion by the character of the vomit. Large quantities, more than a normal stomach could hold, may be ejected at once, often with much subsequent relief, and this accumulation to distention and ejection repeats itself in the course of every few days. The Duke de Chausnes, a famous gourmand of Paris, was in the habit of vomiting a gallon at a time, and common washbowls are often filled with the rancid discharges of gastric catarrh and cancer. The vomited matter shows signs of decomposition. The antiseptic action of the gastric juice is overcome by the acetic and butyric fermentations. The matter contains also sarcinæ with various micro-organisms which are destroyed in the healthy stomach after the hydrochloric acid becomes free.

The absorption of gases from the stomach leads to various nervous symptoms. In most cases there is depression of spirits. The condition is commonly encountered in the case of hypochondriacs. Occasionally symptoms of greater gravity show themselves. These are the patients who sometimes fall into states of coma to be mistaken at times for apoplexies. Coma belongs to gastrectasia as well as to diabetes, and results, as in diabetes, from a peculiar acid intoxication of the nervous system through the blood. There is in these cases the same peculiar alteration of respiration, the same deep, forcible breathing, and the same fatality seen in diabetic coma.

In *diagnosis* the condition must be distinguished from distention of the colon. Doubt may be cleared up by filling the colon with water or air. Dropsy, as from cirrhosis or other ascites, cystic tumors of the pancreas, ovary, etc., may be, as a rule, readily excluded.

The *prognosis* takes color from the cause. Gastrectasia due to cancer has a fatal prognosis; due to stricture, has a prognosis favorable or fatal, as the stricture may be accessible to the sound or the knife after laparotomy. Gastrectasia due to catarrh or paretic conditions of the muscular tissue may be entirely relieved.

In *treatment* main reliance is placed upon the use of the stomach tube, whereby the stomach is thoroughly emptied, its irritating contents removed, and the patient properly fed with appropriate food. Even the irremediable cases secure great relief of suffering in this way. Pain, eructations, heartburns, vomiting, insomnia, depression of spirits, all disappear often after the first use of the stomach tube. Under the continued use of it once or twice a day, as may be necessary, the underlying condition is addressed, if it may be reached at all, with appropriate remedies. Digestion may be stimulated by hydrochloric acid gtt. x.–xv. in a wineglass of water before meals; by bitter tonics, gentian, cinchona, condurango, more especially by the tincture of nux vomica gtt. x.–xx. in a wineglass of water before

meals; strychnia itself; faradization. The stomach may be flushed and the associate constipation overcome by the use of Carlsbad salts (artificial), a teaspoonful in a glass of hot water before breakfast; or tone may be imparted to a weak-walled stomach by rhubarb in the form of the compound pill, cascara sagrada in tablet or cordial. It goes without saying that in these patients the habits of life must be regulated as regards exercise, food, surroundings.

Operative procedure in mechanical occlusion from cancer is reduced in our day to a resection and gastro-enterostomy.

GASTRALGIA.

Gastralgia (γαστήρ, stomach, ἄλγος, pain)—neuralgia of the stomach—belongs among the neuroses of the stomach. Of these neuroses it is about the only one whose nature we know. The trophic neuroses, the secretory neuroses, which produce alterations in the structure and function of the cells, and which preside over the formation and flow of the gastric juice, are mostly beyond our ken. Attempt has been made to estimate the mechanical movements of the stomach—that is, to know something of the motor neuroses—by observing the length of stay of food in the stomach. A healthy stomach should empty itself completely in seven hours after the ingestion of a certain meal. Food found in the stomach at or after this time indicates lack of tone in the muscular coat. Ewald endeavored to discover the rapidity with which a substance was moved out of the stomach into the intestine by the use of agents which, insoluble in the stomach, were dissolved in the intestine to be absorbed by the blood and show themselves in secretions. Thus salol is insoluble in the stomach, but soluble in the intestinal juice, where it is resolved into carbolic and salicylic acids. Salicylic acid is quickly eliminated from the kidneys, and recognized in the urine by the addition of a few drops of the tincture of the chloride of iron, which imparts to the fluid a deep-brown color. Salol may be recognized in the urine in half an hour to one hour after its ingestion into the healthy stomach. A failure to recognize it for two to three hours indicates disease. The objections to estimates made by this method are that, first, there is sometimes delay in physiological states; second, the method requires examination of urine and such an amount of time as to make it impracticable. Penzoldt next administered pills of the iodide of potassium, coated with keratin, which met both these objections, in that the iodine is recognized in the saliva in from six to twelve minutes after its ingestion into a healthy stomach. It is only necessary in these cases that the patient should expectorate upon a piece of filtering paper saturated in a solution of starch. The iodine in the saliva strikes a blue color at once. In cancer at the pylorus, with

dilatation, absorption is delayed often one hour, at the fundus often twenty minutes. Unfortunately the keratin envelope is sometimes dissolved in the stomach to invalidate conclusions, so that up to the present time this testimony can be regarded only as corroborative, and the most practical deductions are drawn from the presence or character of the contents of the stomach as withdrawn by the stomach tube.

Pathology and Symptomatology.—Gastralgia is an affection of the sensitive nerves. The condition manifests itself in *pain*, which is often excessively severe. Gastralgia is, as the name implies, a neuralgia of the stomach. Strictly speaking, the condition as a separate disease is a pure neurosis. There is often, however, very great difficulty in separating neuroses from organic affections. All the diseases of the stomach are marked by pain: gastric catarrh, gastric ulcer, gastric cancer are all associated with pain. Attacks of gastralgia occur in connection with all these diseases, but gastralgia is considered as a separate disease only when dissociated from organic affections. True gastralgia occurs as the result of abnormal ingesta—abnormal in themselves or abnormal to the individual on account of idiosyncrasy—or is the result of the altered condition of the stomach nerves, a kind of hyperæsthesia. Finally it may be reflex. It is not exactly true that what is one man's meat is another man's poison, but it is true of some things in certain cases. Shell fish not infrequently excite attacks of gastralgia. There are individuals who may not partake of oysters, many more who may not eat clams, without suffering pain. Ice water produces attacks in certain individuals, strawberries in others. There are not lacking individuals who suffer after taking milk. These abnormalities may develop when they may not have existed before, in or after attacks of illness of various kinds.

In the majority of cases gastralgia is the result of an altered nervous system. A large number of cases occur in hysterical females, especially in connection with menstrual disturbances, or with individuals who show other neuroses, asthma, migraine, or other neuralgias. Gastralgia is often an outward sign of an underlying condition, an unstable, mobile, excitable state of the nervous system. This condition is sometimes produced by excesses which lead to exhaustion, by alcohol, tobacco, tea, and coffee, more especially by diseases which sap the nutrition or directly poison the nervous centres—anæmia, diabetes, Bright's disease, malaria, rheumatism, etc.

Under the head of reflex causes are diseases of the genito-urinary system, various affections of the uterus and ovaries. Salpingitis and prostatitis have been found to produce exquisite gastralgias. In cases where relationship has been established cure of the cause cures the consequence.

Gastralgia shows itself in acute and subacute or chronic forms. In the acute attack the pain comes on suddenly, often without premonition, and distinguishes itself by its intensity. The pain is located at the pit of the stomach, or irradiates thence to the back or sides, and is frequently associated with a precordial pain and anxiety. Certain cases of pseudo-angina are cases of gastralgia. The attack is often associated also with the various symptoms of dyspepsia, and is relieved at times by the discharge of large quantities of gas, at times again by a profuse sweat. In the more chronic cases the pain is less intense; it is more continuous. There are intervals of comparative relief, with attacks at times excruciating in severity, especially as the result of any imprudence in diet or exposure to cold.

Diagnosis.—Gastralgia must be separated from intercostal neuralgia, enteralgia, muscular rheumatism, gall-stone colic, and the dyspepsias of organic diseases. Location of the pain usually suffices to distinguish neuralgia of the stomach from that of the intestine. The discovery of painful points between the ribs, near the sternum, in the axillary line, and in the vicinity of the spinal column suffices to separate intercostal neuralgia. Muscular rheumatism, pleurodynia, is more especially aggravated by motion and is unattended with dyspeptic phenomena. Gall-stone colic affects more especially women past the middle period of life. The condition may be distinguished by the existence or history of jaundice, by a distended gall bladder. Hepatalgia may be separated from gastralgia only by the fact that the pain is more strictly localized in the region of the liver. It is of much more importance to be able to recognize the cause of the disease, whether due to food, bad habits, chlorosis, Bright's disease, etc., as the future of the case depends entirely upon its cause. In locomotor ataxia the attacks occur as "crises," caused by sclerosis of the vagus at its origin and in its course (Landouzi). The gastralgias of hysteria occur in connection with psychical disturbance and alternate with other neuralgias. Reflex gastralgias are most pronounced in pregnancy and the puerperium.

Gastralgia is for the most part a curable condition. It is often a relief to the practitioner to be able to discover a pure neurosis as distinct from an organic disease.

Treatment.—Sometimes the pain is relieved at once and the nature of the disease recognized by a single application of the galvanic current, anode between the shoulders, cathode at the pit of the stomach. Electricity seems to have more direct control over these than over any other forms of neuralgia. The daily application of a mild current for five minutes for several days suffices to cure simple cases. The diet and habits of life must be regulated. Chlorosis is treated with iron; a tablespoonful of the simple carbonate with

about half a tablespoonful of sugar of milk three or four times a day makes an eligible preparation. The compound mixture of iron, though an inelegant, is a very efficacious form. It may be substituted later with a compound pill of iron. It may be deemed advisable to give the iron in combination with hydrochloric acid, whereby it is preferable to administer the drugs separately. The value of arsenic has always been recognized; three to five drops of Fowler's solution of arsenic in a tablespoonful of water after meals is almost routine practice. Bismuth, in doses of ten to twenty grains after meals, proves often of great value. The salicylates, salol, especially of soda, gr. vij.–x. every two to three hours, act often like specifics. Tincture of nux vomica gtt. x.-xx. in a tablespoonful of water, or strychnia gr. $\frac{1}{15}$–$\frac{1}{10}$, are tonics to the nervous system.

The immediate pain must be relieved by anodynes. Two to five grains of chloral in a dessertspoonful of peppermint water often give quick relief. A teaspoonful of bitter-almond water may suffice for a milder case. A severer case calls for opium, best in the form of morphia; gr. $\frac{1}{12}$–$\frac{1}{8}$–$\frac{1}{4}$ in a teaspoonful of cherry-laurel water relieves most cases. In the presence of excruciating attacks resort must be had to morphia subcutaneously, best combined with atropia gr. $\frac{1}{12}$–$\frac{1}{95}$.

DIAGNOSIS, DIET, AND TREATMENT OF THE VARIOUS DISEASES OF THE STOMACH.

The separation of the different forms of disease of the stomach is often easy, but is sometimes very difficult. The differentiation of cancer from chronic catarrh and of gastralgia from simple ulcer becomes at times a real problem in diagnosis. There is in no case any one single symptom which may determine the exact character of the disease. Even the tumor which is supposed to be pathognomonic of cancer is often deceptive. The diagnosis is made by the consideration of all the facts as elicited under patient investigation. There is to be considered first, *age*. An affection of the stomach past the middle period of life is more probably cancer, or, if of long duration, a protracted catarrh. Affections of younger middle age are more likely to be gastralgia and ulcer. To these rules, however, there are many exceptions. Cancer is sometimes encountered between twenty and thirty. An ulcer may last over and prove recurrent at a later period in life, while gastralgia and catarrh may occur at any time. The *sex* of the patient speaks rather in favor of ulcer and neuralgia as against cancer and catarrh. A large contingent of cases of gastralgia occur, as stated, in chlorotic and hysterical females. Ulcer of the stomach is seen also under like conditions. Catarrh occurs rather more frequently in the male sex, while cancer is no respecter of sex

at all. Something may be learned at times by the *appearance* of the individual. Neuralgias and ulcers do not, as a rule, disturb the general appearance; though frequently attended with loss of flesh, they are not inconsistent with an appearance of health. Chronic catarrh is commonly found in hypochondriacal patients. Cancer produces in the course of time that peculiar degradation which is called a cachexia. The cachexia is, however, not peculiar to cancer. It may occur in any long-standing, wasting disease—tuberculosis, Bright's disease, etc.—but shows itself, as a rule, rather earlier in cancer because of the early attack upon nutrition. Exceptional cases of cancer show, however, no cachexia and no marasmus until the very last days of the disease.

The *cause* of the condition, in so far as it may be discovered, may be invoked in explanation. Gastric catarrh may be found associated with irregularities or imprudences in diet, or as an expression of tuberculosis or Bright's disease. Gastric ulcer may be found associated with heart affections or with hyperacidities of the gastric juice. Gastralgia occurs in connection with or alternative to migraine, asthma, though neuroses may be found to have been caused by abuses of alcohol, tea and coffee, tobacco, bodily excesses, etc. Cancer has no known cause. Of the symptoms proper, *pain* is predominant. It occurs in all the varieties of stomach disease, but shows points of distinction in different forms. The pain of catarrh is more diffuse, more or less constant, with exacerbations, dependent more particularly upon distention. It is relieved by eructations, more especially by emptying and irrigating the stomach. The pain of ulcer is more strictly circumscribed. It is certainly more dependent upon the taking of food. As a rule, no food, no pain. It is brought out, intensified, mitigated, or relieved by change of posture. The pain of cancer does not differ very much from that of chronic catarrh. It is apt to be associated with more tenderness to pressure in the right hypochondrium. It disappears, like that of catarrh, with the emptying of the stomach. Gastralgia is for the most part a paroxysmal pain. It is frequently relieved by pressure, more frequently by the ingestion of food. When not more or less continuous it is most assertive when the stomach is empty. It is often much more intense. It is more amenable to relief. It may disappear entirely under antiperiodics, antineuralgics, or under the constant current of electricity.

The *appetite* is permanently ruined in cancer, may be good in the intervals of attacks in ulcer, and is mostly good in gastralgia. The *tongue* is coated in cancer, but clean, as a rule, in ulcer and gastralgia.

Vomiting may occur in any form of stomach disease, but is less apt to show itself in gastralgia. The vomiting of catarrh and cancer

is more prone to occur in states of dilatation, when the stomach discharges large quantities of decomposing and fermenting matter. Blood is vomited only in ulcer and cancer. There may be exceptional cases of violent retching in which the vomited matter or the ropy mucus discharged in catarrh may be streaked with blood, but the presence of blood is an exception. Blood may be vomited pure in both ulcer and cancer. It is much more frequently pure in ulcer, where it is present also in greatest quantity. It shows more frequently the coffee-ground appearance in cancer, as disintegrated by the action of the gastric juice. Blood may, however, assume either character in exceptional cases of either disease.

The penetration of the stomach tube to unwonted depths speaks for dilatation of the stomach which in younger individuals is found in connection with catarrh; in rarer cases as the result of a cicatrized ulcer at the pylorus; in older individuals with cancer. Tumor, when detected unmistakably, speaks for cancer. There is room here for error with reference to outside tumors, as of the liver, pancreas, retroperitoneal glands, or intrinsic tumor, benign tumor, hyperplastic tissue from catarrh, or about an ulcer, etc. The gastric juice shows, as a rule, a reduction of acidity in catarrh, absence altogether in cancer, an increase in ulcer, an unaffected condition in gastralgia. In this way the diagnosis is reached as a rule. Ulcer is the condition most frequently overlooked and confounded with or considered as a simple gastric catarrh. Cancer remains often unrecognized until it displays itself as a palpable mass at the pylorus. But by the interrogation of a patient from these various standpoints, the diagnosis, as stated, is reached as a rule.

Diet.—The dietary is a most important question in the management of stomach disease, and may be considered here in some detail and in connection with the general subject. In the treatment of diabetes, obesity, as well as in stomach disease itself, it assumes more importance than the materia medica. During the existence of fever the body wastes more rapidly, and this waste must be compensated by the administration of food. Food must be administered, therefore, as much as may be handled and disposed of by the stomach. Any fault in this regard of quantity or quality does damage, in that, undigested, it decomposes and remains as foreign matter, to be discharged by the act of vomiting or to become decomposed and add noxious elements to the blood. The most important food in all cases is water. Sixty per cent of the body is water. Water is necessary for the fluidification of the food as well as for the circulation of the blood and other juices. All water contains salt, notably lime salts. One-half of bone tissue is made up of the lime phosphate; the sodium and potassium phosphates make the blood alkaline, and

alkalinity of the blood is a very necessity of existence. Water contains also the sodium chloride which enters into the composition of all the tissues. Sodium chloride, however, exists in such an insufficient quantity in water that it must be continually furnished by solid elements of the food and in the preparation of food. The sodium chloride holds the globulin in solution; it regulates also the diffusion of fluids through animal membranes in the process of osmosis. Necessary as water is in health, it is even more necessary in disease. Water is constantly being given off from the body, from the skin and the various secretions, but especially from the skin in fever to secure the reduction of temperature, and from the kidneys in the elimination of toxines. Water must be, therefore, administered freely to all fever patients. It should stand always in reach or be periodically administered. The *water must be pure.* Cases of gastric and intestinal catarrh often fail to yield to treatment because the diseased state is kept up by the administration of contaminated drinking water. In all cases of doubt the water must be filtered through asbestos or porcelain, or boiled.

The stomach is spared much of its work by the administration of food in fluid form. The best food is milk. Milk is a complete food. It has the advantage, in the first place, of fluidity; it has the great disadvantage that it will not keep. Another disadvantage lies in the fact that, though administered in fluid form, it often becomes solid and is rejected as a coagulated mass. To obviate this evil, milk is sometimes substituted by buttermilk. Buttermilk is a good substitute in summer; buttermilk is bad in winter. Artificial fermentations may substitute milk, as in the form of kumyss, the taste of which is objected to by many patients. To obviate the evil of coagulation it is only necessary to dilute milk. This dilution may be secured in cases of intestinal catarrh, or excessive sensitiveness of the stomach, with lime water $\frac{1}{4}$–$\frac{3}{4}$. Coagulation is sometimes prevented by the addition of a small quantity of bicarbonate of soda. The best solution is secured with soda water, Apollinaris or Selters (imported) water, half and half. In this dilution the milk is never coagulated *en masse,* and is very rarely rejected by the most delicate stomach. In this exceptional case, or where it is deemed advisable to change the form of the milk, the curd may be separated and the milk given in the form of whey. A teaspoonful of lemon juice added to a pint of milk secures this separation, and the whey may be made richer if, during the process of straining, the curd be squeezed that only the casein be retained. This whey may be administered by itself or in combination with various other foods, with diluted eggs, with bread crumbs, with a dash of rum or brandy, or with wine.

Egg is also a complete food, but too concentrated for a diseased

stomach or for the febrile condition. To be digested it must be diluted with hot water and administered thus pure or after straining through a linen cloth. An egg in a glass of sherry is concentrated nutrition. Diluted egg in wine whey in a cup of tea, with or without a teaspoonful of cognac, is strong food. Custards of milk and egg are delicate, palatable, and nutritious.

Beef is best administered raw. Scraped raw beef, teaspoonful to a tablespoonful—that is, the extract of the protoplasm without the fibre—mixed with a little warm water, seasoned with pepper and salt, forms concentrated nutrition. The taste is repulsive to some patients. A piece of beefsteak may be then very lightly broiled, that the aroma of cooking may stimulate the flow of the digestive juices. According to the experiments of Fick the stomach digests raw three times as quickly as cooked meat. Beef tea, chicken soup, mutton broth, are valuable contributions to the dietary. The best beef tea is made by taking a pound of lean beef, cut in strips the size of the finger, and a pint of cold water, to which is added a teaspoonful of salt. It is to be allowed to simmer fifteen minutes, *but not to boil.* A stronger preparation, known as beef essence, is prepared by placing the strips of cut meat or chopped beef in a wide-mouthed bottle, which is inserted into a vessel of boiling water and allowed to remain for half an hour. Beef tea or bouillon may be used also as a basis, to which may be added crumbs of bread, or strained egg, or various vegetables, whose juice and flavor may be taken without the substance. Carrots, turnips, parsnips, celery, are vegetables used in this way. The juice of the fresh oyster is a stimulating, nutritious food which the most delicate stomach will rarely reject. The soft part of the oyster itself, the body without the muscle, is, as a rule, easily digested. It must be taken fresh from the shell, with pepper and salt, lemon juice, and horseradish. The white meat of fish, if properly prepared—an art seldom understood in inland places ("forty religions and but one sauce")—is delicate food. Sweetbreads stewed in milk are very digestible. The white meat of broiled chicken, pheasant, quail, short-fibred meat, is much more easily handled than that of geese, ducks, wild fowl, wild game. There is often craving for farinaceous food. The simplest forms are the gruels: a glass of water with a piece of toast inserted into it, cornmeal gruel, oatmeal gruel, barley, rice. Milk may be thickened with flour, with arrowroot or tapioca as articles of light diet for fever or for gastric catarrh. Fine white bread of wheat is much more easily digested than that from any other grain. Starch may be tried first in the form of toast. The "zwieback" is a good beginning. Coffee and tea are often necessary stimulants and adjuvants. They may be even fortified with rum or brandy, or the coffee may be made black,

as in cases of heart failure, opium poison, etc. As a rule these beverages are not contra-indicated in fevers. The value of them in these states depends more upon the stimulation of heat which is thus introduced into the stomach, and they are made more palatable by the flavor of tea and coffee. They may be advantageously substituted often by chocolate, which imparts more solid nutrition; or, in cases of intestinal catarrh, by cocoa, a light form of which is found in the so-called acorn cocoa. It may become a necessity at times in the treatment of disease of the stomach, especially in cases of ulcer or in the presence of hæmorrhage, to abstain from food altogether and support the patient by nutrient enemata. Enemata are poor substitutes at best. Bäumler has shown that only about one-fourth of the most nutrient matter is absorbed from the rectum. The beef-pancreas emulsion of Leube may be used in this way. Foods which have been partly predigested, as in the case of the peptonized preparations, may be tried by the rectum as well as by the stomach.

In the *treatment* of chronic gastric catarrh Leube's series of four diet lists, graded from the lightest up, is as good as any: 1. Bouillon, Leube-Rosenthal meat solution (beef boiled twenty-four to thirty-six hours, with the addition of dilute hydrochloric acid), milk, raw egg, zwieback, crackers (without sugar), Apollinaris, Selters, Vichy water. 2. Boiled calves' brains, thymus gland of calf (sweetbread), boiled chicken (young without skin), boiled calves' feet, milk gruels with tapioca, whipped egg. 3. Raw beef chopped fine, raw ham chopped fine, beefsteak lightly broiled with fresh butter, fine scraped beef (loin), white bread, potato purée, coffee and tea largely diluted with milk. 4. Roast chicken, roast pigeon, roast venison, roast beef (cold), veal (choice), macaroni, rice gruel, spinach (finely chopped), asparagus, steamed apple, the lightest white and red wine. Food should be taken every three or four hours in small quantities, never in a state of fatigue, and the patient must stop short of satiety. Small quantities of alcohol aid digestion ; champagne or other effervescent forms hinder it, still more so do fruit wines. Beer may be taken in small quantity some time after meals. Caviare, sardelles, ham and smoked meats excite the appetite through creosote; with the development of much gas, vegetables, fresh bread, all fruit and milk must be avoided. Bad breath is obviated by avoiding fresh albumen. The meat in these cases should be smoked.

Regular habits of rising and going to bed, exercise in the fresh air, morning baths, cultivation of a cheerful disposition, are adjuvants. The mineral waters, especially at their sources, are most valuable. They may be substituted at home by artificial products, common salt, Carlsbad salts, the carbonated waters of the soda fountains, Vichy water, which in cities may be decanted into bottles

at the drug store and served at home like beer. As stated already, no drug equals dilute hydrochloric acid, gtt. x.–xx. in a wineglass of cold water before or after meals. Pepsin may help; still better is pancreatin, gr. xv.–xxx. after meals. The physician must have the help of an honest apothecary with these preparations. Of bitters choice may be made of quassia, gentian, calamus, absinthe. Two excellent bitters are fluid extract of condurango bark gtt. x.–xv., and the tincture of rhubarb ʒ ss.–i. diluted. Creosote is one of the finest contributions of modern therapy. It shows its virtue in that most obstinate of all forms connected with and based upon tuberculosis. It may be given in capsule gtt. i.–ij., or, better, with equal parts of tincture of nux vomica, rhubarb, or gentian; and the dose may be of the mixture gtt. v.–x. in wine (sherry), or whiskey and water equal parts, a teaspoonful to each drop. An appetizer of much promise in bad cases of gastric catarrh, tuberculosis, Bright's disease, etc., is orexin. Care must be taken to secure the basic orexin, as the acid form burns the stomach. It is given best in capsules, gr. v. twice a day with much fluid. The appetite sets in sometimes after the first dose and continues, or again only after several days, or only after each dose. It acts by exciting the flow of hydrochloric acid. Sometimes it produces a ravenous appetite; sometimes it fails (Penzoldt). Vomiting may be checked best by irrigation with the stomach tube, which is always the sovereign remedy, by small doses of chloral in peppermint water gr. ij.–v., by tincture of belladonna gtt. x., or chloroform gtt. v.–x. on sugar, or cocaine or morphia, or morphia with atropine. Morning vomiting is brought under control best by atropia gr. i.–ʒ i. solution, dose gtt. ij.–v. at bedtime. Vertigo is relieved by chloral gr. v.–xv.

Surgical measures are always called for in desperate cases. Billroth, in the review of his one hundred and twenty-four cases of operations on the stomach and intestine in the past twelve years, records a rescue of one-half of all the cases of all kinds. Metastases and recurrence took place, of course, in carcinoma, quickly in the gelatinous and cylindrical forms, more slowly in scirrhus, but surgical intervention gave relief in all cases, showing striking contrast in this regard with the cases left to fate.

CHAPTER III.

DISEASES OF THE INTESTINE.

INTESTINAL CATARRH.

CATARRH of the intestine differs from that of the stomach in that, while it is in the acute form more frequent, it is in the chronic form less frequent. Catarrh of the intestine when chronic depends, as a rule, upon some outside disease. Acute intestinal catarrh is perhaps the most frequent of all diseases. It constitutes a large contingent of cases of diseases of infancy, where it is encountered in its most exquisite expression.

Pathology and Etiology.—Catarrh of the intestine results first from fault in the ingesta. It is the fluid rather than the solid food which is most at fault. The chief fault lies with drinking-water. Contamination of drinking-water by the discharges of other cases of intestinal catarrh, or of other diseases altogether, is the most fruitful source of this affection. The disease may in this way assume epidemic proportions. When it shows itself in intense degree, affecting also the stomach, it constitutes the affection commonly called cholera morbus. Any great fault with the ingesta affects the stomach as well as the intestine, to produce the condition commonly called gastro-intestinal catarrh. That cholera morbus results often from contaminated drinking-water is proven by the fact that in so many cases the discharges contain various micro-organisms.

Cholera morbus, or that intensely acute expression of gastro-intestinal catarrh, is, however, by no means always due to this cause. It may result from the other causes of intestinal catarrh. Bad food is responsible for fewer cases. Decomposing meats, spoiled fish, unripe vegetables, decayed fruits, account for individual cases. Where the process of decomposition is not too far advanced it is arrested under the antisepsis of free hydrochloric acid in the stomach—a process which is continued for a short time in the intestinal canal. The food that causes the most irritation is milk. It is unfortunate that the food upon which most reliance is placed to substitute the mother's milk is the most prone to decomposition. Intestinal catarrh results also from toxic cause, as from the action of poisons, arsenic,

corrosive sublimate, or too intense action of the various purgatives. Herein is included also the action of specific diseases, typhoid fever, tuberculosis, rickets, cholera, dysentery, etc. There may be abnormal excitability of the sensory or secretory nerves. Influence of the nervous system is perceived in cases in which intestinal catarrh results from exposure to cold, which, in certain individuals, will always produce diarrhœa. Fright may have the same effect. Intestinal catarrh results also from disturbances in the circulation. It is found in connection with disease of the heart and lungs, more especially in association with disturbances in the portal circulation, in cirrhosis of the liver, etc. The absorption of chemical products, ptomaines, toxines, is responsible for certain cases. The intestinal catarrh which results from the mere presence of micro-organisms is often salutary, in that it secures their expulsion, as in the case of trichinosis. Where peristalsis is easily excited, as in children, the individual is protected against disease in this way. Many of us owe escape from various infections to the fact that, in the first place, the poison is destroyed in the stomach by the gastric juice or is hurried out of the intestinal canal by rapid peristalsis.

Symptoms.—Catarrh of the intestine shows symptoms which differ according to the location of the affection. The condition rarely extends to involve the whole length of the intestinal tract, but is manifest more especially at one or the other extremity. The most common expression of intestinal catarrh is *diarrhœa.* Diarrhœa, however, is only a symptom. Under the rapid peristalsis the contents of the intestine, for the most part digestive juices, are hurried along the canal before there is time for their reabsorption. Many pounds of these digestive juices are secreted during the day. All of it, or nearly all of it, is reabsorbed into the blood. The stay in the intestine is just long enough to secure fluidification and absorption. In hypersensitive, irritable states of the mucous membrane the muscular coat propels the contents of the intestine along its course too rapidly to permit absorption. The mass of the discharges, therefore, is made up of digestive juices. Catarrh located in the duodenum, which exists for the most part in connection with catarrh of the stomach, manifests itself by the very opposite condition, to wit, *constipation.* More or less *tenderness* may usually be felt in the region of the pylorus. There is usually anorexia, frequently nausea, and not infrequently *icterus.* The catarrhal process, which thickens the mucous membrane, occludes the orifice of the bile ducts. Sometimes it invades the bile ducts to lead to the same occlusion, and but very slight swelling is necessary to block the bile ducts and necessitate the reabsorption of bile into the blood. Hence most of these cases are associated with jaundice. Catarrh of the jejunum may not be dis-

sociated from catarrh of the ileum. The known seats of the lesion of typhoid fever and tuberculosis in the ileum enable us to exclude the jejunum from participation in these affections. In the rare cases in which dysentery invades the small intestine its lesions are confined about the ileo-cæcal valve.

The point of greatest practical importance is to separate the affections of the small from the large intestine in the effort to secure local therapy. In a normal state the contents of the small intestine are fluid, of the large intestine more or less solid. Copious discharges of fluid matter usually come from the small intestine; smaller discharges of more solid masses, scybala, come from the large intestine. Ordinarily the bile is reabsorbed in its passage through the small intestine, so that it does not appear in the large intestine. Quantities of *bile* with the stools, which impart to them their greenish color, indicate a discharge from the small intestine, provided always the gall ducts be not blocked, in which case, however, there is usually constipation. A better evidence of discharge from the large intestine is the presence of *mucus*, alone or coating the exterior of the mass. The character of the *blood or pus* sometimes discharged from the stools indicates also the seat of the disease. Blood from the small intestine is usually intimately intermingled with the discharge; from the large intestine it is either voided pure or it streaks or coats the outside of the mass. In some cases the stools are composed almost entirely of water. The stools of cholera morbus and cholera are ninety to ninety-five per cent of water. In these cases water is not only voided from the intestinal canal, but is drained also by osmosis from the blood, and with such rapid exudation as to macerate and detach the epithelial cells which appear to constitute the rice-water discharges of these diseases. In these cases the stools have lost all natural to assume a peculiar odor. Something may be learned from the *odor* of the discharge. An acid odor frequently observed in the discharges of childhood indicates for the most part decomposition of vegetable food; a putrid odor, decomposition of animal food. Naked-eye inspection, more especially as assisted by the microscope, gives information as to the degree of digestion. Particles of undigested fat indicate, for instance, absence or defective action of the bile and pancreatic juice. Undigested muscular fibre shows defective action of the intestinal as well as of the gastric juice. Particles of starchy food, unaffected or but little affected, masses of detritus, unattached or undigested residue, constitute the condition known by the older writers as lientery. Miller called attention to the fact that where the catarrhal process is slight the lack of digestion first concerns the *fats;* where extensive it concerns *all kinds of food.* Bacteria and protozoa abound in the fæces of intestinal catarrh.

Intestinal catarrh manifests itself also by *pain*. The pain is more acute in accordance with the degree of distention of the intestine by gas—colic. Colic is often relieved by pressure. Usually, however, there is more or less tenderness over the whole region of the abdomen. The escape of gas or its wanderings constitute the rumble or borborygmi and show increased or irregular peristalsis and paretic states.

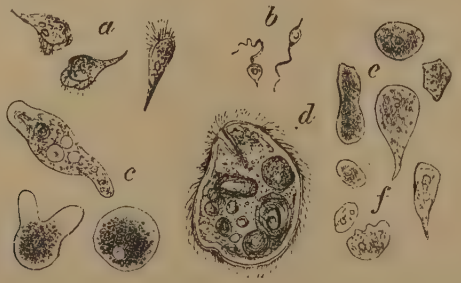


FIG. 184.—Protozoa in the fæces: *a*, Trichomonas intestinalis; *b*, Cercomonas intestinalis; *c*, Amœba coli; *d*, Paramecium coli; *e*, monadines, living; *f*, monadines, dead.

Forms of intestinal catarrh are divided usually into duodenitis, ileitis, colitis. A peculiar variety of inflammation, situated at or about the head of the large intestine at the cæcum, is commonly known, from the Greek equivalent of cæcum, as typhlitis. The dis-

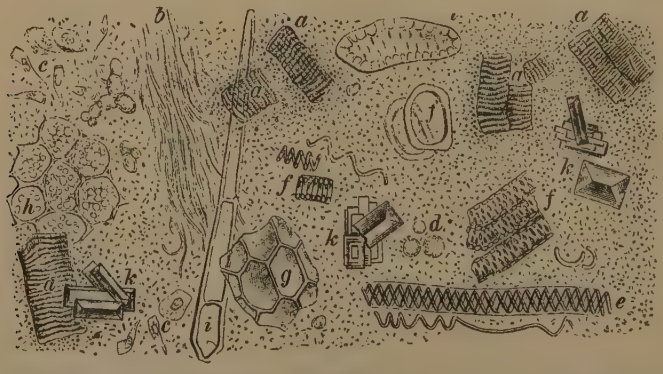


FIG. 185.—Fæces under the microscope: *a* muscle fibre; *b*, connective tissue; *c*, epithelium; *d*, white blood corpuscles; *e*, spiral cells; *f–i*, various plant cells; *k*, triple phosphates. Interspersed are various micro-organisms (Von Jaksch).

ease begins, as a rule, in the vermiform appendix and is often known as appendicitis. It is an especial variety of intestinal inflammation, which from its frequency and gravity merits especial consideration. Colitis is usually described with dysentery. Dysentery is sometimes a specific colitis, prevailing often in epidemic form. It, too, merits especial consideration. Inflammation in the rectum is known

as proctitis. The rectum is also secondarily involved from inflammations outside, in connection often with the uterus, or as a localization of a septic process, peri- and paraproctitis. The rectum is also a final habitat of the tubercle bacillus, which erodes its tissue to form perineal abscesses and result in fistulæ.

Diagnosis.—The important point in the consideration of intestinal catarrh is the recognition of its cause. In acute intestinal catarrh this cause is usually obvious in fault with the food. In chronic intestinal catarrh the cause, as stated, is most frequently outside the canal. In some cases the mucous membrane undergoes a degeneration as part process of a widespread affection. This is particularly the case in amyloid change, which almost always occurs in connection with amyloid kidney and is recognized by the signs of that disease. Bright's disease not infrequently causes intestinal catarrh through mere œdema—a salutary process by which urea is eliminated. Ulcerative processes, as from typhoid fever, tuberculosis, dysentery, carcinoma, syphilis, must be always carefully eliminated. They constitute, as stated, the mass of cases of chronic intestinal catarrh.

The *prognosis* depends altogether upon the cause. It is for the most part favorable in the acute forms of the disease, but is often excessively grave in childhood. Infants succumb quickly unless radical change can be made in the diet. Summer diarrhœa, as it is called, is the most fruitful cause of death in infancy. It occurs in the second summer, because it is at this time that the child is put upon outside food. The chronic diarrhœa which is so fatal to childhood, constituting the mass of cases which are called marasmus, is an expression for the most part of tuberculosis. All tuberculous patients are affected with diarrhœa sooner or later from deglutition of the sputum. Children never expectorate, so that they show affection of the intestine out of all proportion to that of the lungs.

The *treatment* of acute intestinal catarrh in infancy is a matter wholly of diet. It depends upon fault in diet and is remedied only by its correction. The great contingent of cases is furnished by children fed with artificial food. The only real remedy is a wet-nurse. All other remedies are of secondary importance. No artificial food, milk of no animal, will really substitute mother's milk. The experiment is usually tried of substituting one form of food after another. Sometimes it succeeds; as a rule it fails, and if a wet-nurse may not be obtained, and that quickly, the result is frequently fatal. The infants' foods in the market are numerous. Resort must be had to them in certain cases. Perhaps most use is made of condensed milk, milk with wheat, peptonized milk. The food that should be tried first in all cases where mother's milk may not be obtained is the milk of the cow. Failure is experienced often with cow's milk be-

cause it is given in form too concentrated. It should be diluted always. In the case of a healthy child the mixture is made, for the first three months, two parts water and one part milk; for the second three months, equal parts; from the sixth month on the water is gradually reduced until pure milk is given. In intestinal catarrh at whatever age, even in advanced life, milk, which still constitutes the best food, must be diluted as if for infancy. The dilution may be made two-thirds, one-half, one-third, with lime water, with simple water, pure, preferably with soda, Selters water, when it may be handled by the most delicate stomach. In adults the milk may be substituted with, or there may be given in addition, *malted milk*, beef tea, chicken soup, mutton broth, later rice and barley, still later crumbs of bread, or zwieback or egg at first diluted as before directed. Aside from the specific diseases which require special treatment, all irritating ingesta must be first removed. The remedy which best secures this effect in either childhood or age is calomel. Calomel purifies as it evacuates. It still merits all the praise which has been expended upon it in the treatment of these conditions, and has not yet found a substitute. It is a remedy which can be given with great impunity in childhood and age, though with some reserve in continued administration in adult life. It may be given alone or combined with chalk. Favorite prescriptions are calomel, bismuth, and soda; calomel, ipecac, and soda; calomel, salol, bismuth, etc. Luff declares that the biniodide of mercury, in a dose of one milligramme every three to five hours, cures eighty per cent of cases of summer diarrhœa.

Catarrh of the duodenum usually calls for laxatives, at the head of which, in this case, stands Carlsbad salts, of which there may be taken a teaspoonful in a glass of hot water two or three times a day before meals. Frequent libations of any alkaline mineral water, Congress water, Vichy water, are of value.

In catarrh of the small intestine address must be made to the pain, and in this regard no remedy equals opium. Opium stops the peristalsis and obtunds the hyperæsthesia of the sensitive nerves. A fine old combination is that which contains also diluted nitric or hydrochloric acid with a little camphor:

℞ Tincturæ opii.....gtt. xl.–lx.
Acidi hydrochlorici diluti.....gtt. xl.
Aquæ camphoræ.....ad ℥ iv.
M. S. A tea- to a tablespoonful every two to four hours.

Broken doses of bismuth gr. v.–xv. alone, or in combination with salol gr. iij.–v., or salicylate of soda gr. v.–x., or with a grain or a fraction of a grain of ipecac, or with one to three grains of Dover's powder, make nice combinations for individual cases. Infants and individuals who are extremely sensitive to cold may be protected

against attack by warmer clothing, by flannel bandages, or an extra undergarment. A tablespoonful of brandy for an adult, with a dose of quinine gr. v.–x., or Dover's powder gr. x., taken at night after an exposure, to quicken the circulation and dissipate chemical poison, will often prevent an attack. Irrigation of the intestine is as effective in the treatment of intestinal catarrh as in the case of the stomach. The fluid should be introduced in infants with a soft catheter, which, warmed and oiled, may be carried into the bowel six to twelve inches. The bowel is thus thoroughly washed out once or twice a day under careful injection, as in a case of dysentery, where the process is described. The fluid may be medicated, as by a few drops of creosote, by the salicylate of soda ʒ ij.–Oij., by alum ʒ ss.–Oij. Not a little of the good accomplished with injections is due to the absorption of water by the drained-out bowel. Warm baths are especially beneficial in the intestinal catarrh of infancy, and obstinate cases of chronic intestinal catarrh are sometimes brought under control by small ℥ i.–ij. rectal injections of acetate of lead gr. x.–℥ i. An opium suppository at bedtime, or a clyster of starch ℥ ss., tincture of opium gtt. x.–xv., gives comfort for the night, or repeated after each stool checks diarrhœa. A fraction of or a whole teaspoonful of brandy in hot water with a little sugar is a valuable aid in childhood. Cholera morbus is usually cut short at once in an adult by a subcutaneous injection of a quarter of a grain of morphia.

INTESTINAL ULCER.

Intestinal ulcer—ulcus intestinorum, entero-helcosis (ἕλκος, ulcer)—represents a solution of continuity in the wall of the intestine, affecting first, as a rule, its mucous coat. Ulcer of the intestine, like ulcer of the stomach, its occasional congener and not infrequent associate, is the expression of an insult or injury offered to the intestinal coat in its inner exposed surface, or the result of a local occlusion in the general blood supply. Hence ulcer of the intestine may be a purely local disease, or be the local expression of a general, so-called constitutional disease. While in many cases the lines differentiating these conditions may not be distinctly drawn, as many so-called constitutional conditions (tuberculosis, typhoid fever, etc.) are discovered to be, at first at least, local processes, the toxic ulcer (arsenic, mineral acids) may be taken as a type of the local process acting from within, and the syphilitic ulcer as a type of the local process acting from without. At the same time it must be recognized of syphilis that an ulcer may result from the dissolution or breaking down of a gummatous mass anywhere in the course of the intestine, or may be the effect of infection by extension into the rectum of syphilitic processes

about the genital organs, or, lastly, of direct introduction of the disease in perverted intercourse (pæderasty, coitus heterotopicus).

Ulcer of the intestine is occasionally, though comparatively very rarely, observed also as the result of pressure from within or without. Such an ulcer is properly considered of traumatic or mechanical origin, as it is induced as the direct effect of mechanical irritation or arrest of blood supply. Thus dense masses of inspissated fæces, foreign bodies, indigestible residue of food may fret the mucous surface into a condition of hyperæmia and later absolute ulceration. Undue retention, as behind a cicatricial contraction, or an occlusion from whatever cause at places where the intestinal tube normally offers resistance (at the ileo-cæcal valve, sigmoid flexure, etc.), may lead to ulceration in the same way. Schönlein has called attention to the paralytic condition of the intestinal muscularis in age as a predisposing cause of mechanical intestinal ulcer; and Virchow has noticed the same condition among the insane, whose intense preoccupation leads to neglect of evacuation of the bowels. Certain intestinal parasites, more especially ascarides, are admitted as occasional causes of ulceration, and more superficial solutions of continuity in the rectum have been noticed as the result of too frequent or too careless use of enemata.

Curling was the first to call attention to the fact that extensive burns of the skin are sometimes followed by ulceration of the intestines. The ulcerative process is almost exclusively confined to the duodenum, and is due to erosive action of the gastric juice, continued in the intestine upon a tract or section of mucous membrane whose blood vessels are blocked with dead blood corpuscles. Whatever the cause, the frequency of its occurrence makes it more than a mere coincidence. According to Meyer, it is observed most in women, and shows its first symptoms in seven to fourteen days after the initial burn.

Aside from toxic and traumatic causes, ulcer of the intestine occurs as the result of dysentery, typhoid fever, and tuberculosis—diseases mentioned in the order of frequency in the production of the process. The ulcers of dysentery in the large intestine, and of typhoid fever in the small intestine, assume such prominence in these affections—having even been erroneously considered at one time as the cause of these maladies—that their study belongs to the history of these diseases. The ulcer of tuberculosis is rather an incident in the course of this affection, and is now recognized as the occasional result of direct infection by the ingestion of tuberculous milk, but, far more frequently, of the deglutition of tuberculous sputum. As a rule the tuberculous ulcer shows itself late in the course of pulmonary phthisis, and is the cause of the obstinate and colliquative diarrhœa which

speedily exhausts the patient. Yet cases are occasionally met in which numerous or extensive ulcers occur in the intestinal canal early in the history of phthisis, before any serious damage has been inflicted upon the lungs. The tuberculous ulcer affects, and for the most part is confined to, the same structures which form the seat of disease in typhoid fever—viz., the solitary and agminated glands of the ileum. When the bacilli tuberculosis are conveyed to the intestine by means of the lymph and blood supply through the mesenteric vessels, the resulting ulcer takes the shape of the vascular arrangement; that is, the long axis of the ulcer is at right angles to the course of the tube. Thus, if sufficiently extensive, the ulcer may be circular or form a girdle or ring entirely around the tube. With the tubercular ulcer or ulcers are usually found tubercular nodules and plaques in the serous coat, which are visible to the naked eye as opacities or milky deposits beneath the peritoneal coat. The glands of the mesentery may be at the same time so much increased in size as to form visible or palpable tumors in the abdomen. The frequency with which tuberculosis affects the vermiform appendix calls for special notice in connection with typhlitis. The ulcer of the intestine which is the result of a catarrhal process, so-called, belongs to the history of chronic diarrhœa and dysentery.

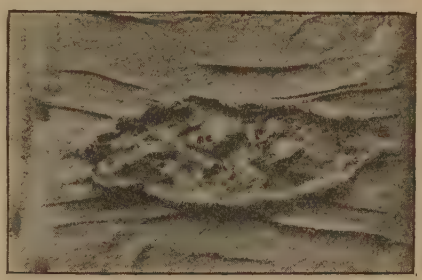


Fig. 186.—Tubercular ulcer of ileum (Medical and Surgical History of War of Rebellion).

The true intestinal ulcer *per se*, which has its analogue in the stomach as the gastric ulcer, ulcus rotundum, is due to the same cause as in the stomach—viz., to arrest of circulation and erosion by the gastric juice. It is a well-established fact in physiology that gastric digestion is continued—is, indeed, mainly effected—in the small intestine; hence an arrest of circulation in the small intestine is attended by the same result. The fact that this so-called peptic ulcer is found almost exclusively in the duodenum speaks most emphatically for this origin of the disease. Arrest of the circulation in the intestinal wall may be due to embolus, which, according to the observations of Nothnagel and Barenski, is not infrequently found in the branches of the duodenal artery; to infarction, the condition so commonly encountered in pyæmia and septicæmia; or to thrombotic occlusion, as seen in amyloid degeneration—a disease process which selects by preference the vessels of the alimentary canal along with those of the kidney and spleen.

The duodenal resembles the gastric ulcer in form as well as origin. It has the same appearance, in its recent stage at least, of hav-

ing been cut out with a punch, shows no inflammation, induration, or thickening about its borders at first, and presents the same funnel shape with terraced walls, its apex below eccentrically situated, as a rule, corresponding to the situation of the artery. It is most frequently found in the upper horizontal portion of the duodenum, but is occasionally, though rarely, seen in the descending portion. In the further course of the duodenum the gastric juice becomes gradually neutralized, so that ulcers situated below the orifice of the gall ducts are very great exceptions. In Krauss' collection of forty-seven cases but two were found in the lower sections of the duodenum. The intestinal, like the gastric ulcer, is usually found single or alone, but occasionally two, three, or even four ulcers are encountered. According to the tables of Morot a single ulcer is found in 81.8 per cent of cases, two in 9.2 per cent, and three and four in 4.5 per cent each.

Duodenal, like gastric ulcers, are attended with liability to hæmorrhage and perforation in equal, if not greater, degree. There is also the same tendency to implication of contiguous structures. Stich records a case of perforation of the aorta, Eichenhorst mentions the formation of abnormal communication with the gall bladder, and Frerichs a thrombosis of the vena porta, in consequence of duodenal ulcer. Lastly, the process of cicatrization may be followed by the same disasters as occur in pyloric ulcers in consequence of contraction and constriction. Thus the orifices of the pancreatic and choledochus ducts may be narrowed or completely closed, or the whole lumen of the duodenum obliterated, with consecutive dilatation of the stomach and œsophagus, as in the case narrated by Biermer. A very nice question in differential diagnosis, as between pyloric carcinoma and pyloric or duodenal ulcer, is sometimes raised in this way. In the vast majority of cases it is safe, even in the absence of a palpable tumor and without regard to the age of the patient, to decide this question in favor of carcinoma. Cases of complete occlusion constitute the rule in carcinoma and the very great exception in ulcer.

It remains to be said that duodenal is much more rare than gastric ulcer, in the ratio of one to thirty, and that, unlike gastric ulcer, it chiefly affects males. According to the statistics of Krauss, already cited, the ratio of males to females is nine to one ; according to Trier, five to one. It occurs in greatest frequency between the ages of thirty and forty, diminishing with advancing age.

Symptoms.—Ulcer of the intestines announces itself by symptoms which are, as a rule, much more vague and indefinite than the same process in the stomach. In a certain percentage of cases the symptoms may be entirely *latent*, and the cause of a sudden death

be revealed as ulcer only on the post-mortem table. In less severe cases the entire symptomatology of intestinal ulcer is grouped under the term dyspepsia, no characteristic phenomena being manifest throughout the course of the disease.

On the other hand, a very small ulcer may give rise to the most dangerous symptoms—hæmorrhage and perforative peritonitis—which may be even fatal in the course of a few days or hours.

Among the symptoms that appear with prominence in the course of the disease is *pain*. Although cases are abundantly on record marked by the entire absence of pain, and although pain is by no means so universally present as in gastric ulcer, it occurs in the great majority of cases. The pain of intestinal ulcer distinguishes itself from that of gastric ulcer by being more independent of the character of the food or the time of taking it. For the most part it occurs in attacks of colic, which are characterized at times by their extreme severity, long duration, and obstinacy to every means of relief. These attacks occur in paroxysms with complete or only incomplete remissions, and are ascribed, as in gastric ulcer, to the erosive action of the gastric juice upon exposed nerve fibres, the intervals of relief corresponding to the periods of exhaustion of the nerve centres. At the same time, in exceptional cases, a long-continued, localized *tenderness* to pressure may indicate the seat of the disease.

Palpation may elicit, besides tenderness, points or regions of *induration* or intumescence. Such a condition is more especially encountered in cases of tuberculous disease, the so-called scrofula of the intestine, the tabes mesenterica of childhood. More localized enlargements are occasionally to be felt in the vicinity of the duodenal or other intestinal ulcer in consequence of circumscribed peritonitis with its resultant agglutinations and adhesions. In this connection caution must be exercised not to confound masses of impacted fæces with tumefactions. The history of constipation or the administration of a light laxative will generally suffice to remove this source of error.

Anorexia is a symptom of intestinal ulcer as a rule. The loss of appetite may amount to a complete aversion to all food or only to the more fatty articles of diet. A curious exception to this rule is not infrequently seen in the unappeasable hunger of children the victims of tuberculous ulceration. The contrast offered in the extreme emaciation of these patients has been made the subject of frequent comment.

With this loss or perversion of appetite and defective digestion of the food the general condition soon begins to fail. Though cases are occasionally met in which a *bien-être* has been maintained for years, or a condition of obesity has been retained, these cases form

the exception in the history of intestinal ulcer. More or less *emaciation* gradually develops as a rule, and a reduction of the general strength that is out of all proportion in its degree to the loss of flesh. At the same time the mental condition of the patient suffers a *degradation* to the level of the sufferer with chronic dyspepsia.

The disturbances of digestion which occur in intestinal ulcer present many varieties in degree and kind. Some patients show none or but few of the signs, while others run the gamut, so to speak, in the semeiology of *dyspepsia*. Heartburn, eructations, pyrosis, borborygmi, flatulence, gastralgias, pseudo-anginas, nausea and vomiting, the familiar phenomena of gastric or intestinal catarrh, attend, at some time or other in the course of the disease, most of the cases of intestinal ulcer.

The condition of the discharges demands notice in detail, more especially as abnormalities in the evacuations belong among the few of the more constant symptoms of the disease.

Diarrhœa is the rule in intestinal ulcer. The discharges consist at first of the undigested food and the digestive juices, which have been hurried along the alimentary canal and prematurely evacuated on account of the increase of peristalsis caused by the irritation in the upper part of its tract. The arrest of the digestive process leads to early decomposition of the ingested matters, and thus imparts to the discharges an exceedingly *offensive odor*. While, in exceptional cases, constipation may be present, or even obstipation of the bowels, the discharges are usually so abundant as to constitute a diarrhœa, which in some cases is so frequent or profuse as to become colliquative and speedily exhaust the strength of the patient.

An ulceration situated in the colon or rectum would furnish the discharges characteristic of dysentery, while the same process in the ileum would show the evacuations characteristic of typhoid fever or tuberculosis.

The most characteristic ingredient of the true duodenal ulcer is *blood*. Ulcer of the intestine constitutes the most frequent source of hæmorrhage of the bowels, which is sometimes so grave as to take life in the course of a few days or hours. The blood from an intestinal ulcer may be evacuated both by the mouth and the anus, or may be retained in the alimentary canal and not appear at all. Such cases constitute the condition known and described under the heading of occult or *concealed hæmorrhage*, which is recognized by the rapid general collapse of the patient. When the blood issues from a duodenal ulcer it is intimately commingled with the contents of the alimentary canal. The discharges in such cases are usually *black, tarry, and more or less fluid;* whereas blood from the colon or rectum still preserves its fresh red color and is discharged separate

from the fæces or simply coats the exterior. Occasionally cases are met where the blood coagulates in the interior of the intestinal canal to form a cast of its lumen or to accumulate in great mass in the sigmoid flexure or rectum. In one case in the experience of the author such an accumulation was the cause of a very severe tenesmus, which was only relieved by the digital evacuation of large masses of inspissated, coagulated blood.

The presence of pus would indicate lesion of the colon, as typically shown in dysentery; for suppuration, at least with any visible products, does not occur in ulcer of the duodenum.

Duration —Ulcer of the intestine has no definite duration. As in the case of its prototype, gastric ulcer, it may speedily be covered with cicatricial tissue and never appear again in the course of a long life. But such a course is as unusual as in gastric ulcer. Frequent recurrence constitutes the rule in intestinal ulcer, or a partial recovery with frequent relapse, as in the course of ulcer of the stomach. So ulcer of the intestine is not infrequently a lifetime malady, with exacerbations and remissions dependent largely upon the prudence or imprudence of the patient with regard to diet. It need hardly be stated that ulcer of the intestine may terminate fatally, even in the course of a few days, from hæmorrhage, circumscribed and, later, diffuse peritonitis, or may drag out a slow length of years to finally destroy the patient with the general symptoms of inanition, hydrops, and marasmus.

Diagnosis.—From what has been said it is plain that ulcer of the intestine is often entirely overlooked or may be readily confounded with other maladies of the digestive tract. Cases of traumatic or toxic origin are generally readily recognized by the history of the patient, and tuberculosis may reveal itself by the youth of the individual, the existence of the disease elsewhere, the gradual emaciation, the premature senescence—in short, the general signs of the phthisical habitus, the meteorism, and perhaps the presence of nodular enlargements of the mesenteric glands. A still doubtful case may be cleared up with tuberculin.

The most characteristic symptom of the peptic ulcer is, as stated, hæmorrhage. But hæmorrhage is present in only the minority of cases, is, as a rule, occasional and transitory, and is at all times difficult of differentiation as to its source. Blood from a gastric ulcer may also be voided per rectum as well as per os, and the blood from a duodenal ulcer after regurgitation may be wholly discharged by vomiting. The absence of vomiting, and the presence—more especially the persistence—of tarry evacuations from the bowels, would speak for ulcer of the intestine. Dilatation of the duodenum, a condition of ectasia, closure of the bile duct with consecutive jaundice,

or the presence of fatty stools from occlusion of the pancreatic duct (a sign not now regarded of the same value as in the days of Bright) would also declare in favor of ulcer of the duodenum. As between intestinal ulcer and catarrh or intestinal ulcer and carcinoma, precisely the same rules would hold as in the case of the stomach. A simple enteralgia would be recognized by its more frequent occurrence among females or individuals of neurotic temperament; by its connection with faults of diet, malaria, or exposure to cold; by the absence of hæmorrhage, diarrhœa, or peritonitis.

Prognosis.—Too much caution cannot be exercised in the prognosis of ulcer of the intestine; for in even the cases which run a perfectly mild course the gravest, even fatal, accidents are liable to occur. The danger of perforation, in cases of typhoid fever, from a single or from one of the few ulcers that may be present imparts one of the chief elements of gravity in this disease; and the same catastrophe may occur at any time in dysentery or tuberculosis. The duodenal ulcer may likewise have a sudden gravity imparted to a mild case by a copious hæmorrhage or a peritonitis; and even though the patient escape all possible complications, though he recover with the surface of the ulcer healed so that the loss of substance is filled in with firm cicatricial tissue, the danger of contraction or stenosis still remains. The ulcers of dysentery in the colon and of syphilis in the rectum are especially liable to be followed by deformities of this kind, while the tuberculous ulcer in the ileum not infrequently results in a more or less complete stenosis. The ulcer of typhoid fever in its cicatrization almost never reduces the size of the intestinal canal.

Treatment.—The most valuable therapeutic means of relieving the pain and obviating the dangers of ulcer of the intestine consist in the regulation of the diet. The food should be light, easily digestible, and during the acute stages of the disease as nearly fluid in its consistence as may be. Milk would be the staple article of diet in all cases, were it not for the fact that in some cases constipation attends its too exclusive use. The various soups, without solids, *malted milk* in hot water, starch (sago, arrowroot, tapioca, etc.), may sufficiently nourish the patient until the healing process shall have commenced. Raw beef chopped up and made into an emulsion is perhaps the most nutritious and least injurious of any kind of food. Bread, potatoes and other vegetables, should be ruled out altogether, because of their liability to produce masses of fæces whose inspissation may do mechanical damage to ulcers in process of cicatrization.

Where there is failure in the general strength early resort should be had to alcohol, which may be administered in the form of red wine (in preference to white, because of the tannin it contains), wine

whey, or, in more serious prostration, of sherry wine, milk punch, egg-nog made with good whiskey or brandy.

In the worst cases, where all food irritates, feeding at the mouth may be abandoned altogether for a time, and the strength of the patient sustained by nutritive enemata of beef or pancreatic emulsion. Ewald uses as an enema two eggs beaten up with a tablespoonful of cold water, to which are added a little starch boiled with a half-teacupful of a twenty-per-cent solution of glucose, and a wineglassful of claret wine. All enemata should be introduced warm, and by means of a long, soft, well-oiled rectal tube, as high up in the bowel as may be. Roberts nourished a patient with occluded œsophagus nine weeks with pancreatized milk, and Donkin supported ten cases of gastric ulcer with enemata of plain milk occasionally varied by clysters of beef tea, three of them for nineteen days (Stewart).

The diarrhœa should be controlled rather than entirely checked, for fear of the greater evil of constipation. A little bismuth with bicarbonate of sodium or oxide of zinc gr. v. may suffice for the milder cases, while in the more aggravated cases resort must be had sooner or later to opium.

Constipation is best relieved by careful injections of warm water or by the administration of the lighter laxatives—mineral waters, seidlitz powders, Carlsbad salts, citrate of magnesia, castor oil, etc.

Vomiting is combated by ice, soda water, cherry-laurel water, chloral with peppermint water, and, in graver cases, by morphia hypodermatically.

Pain may be relieved by applications of hot water, cataplasms, injections of hot water, and, when necessary, by morphia with or without belladonna.

Hæmorrhage is checked by ice internally and externally, turpentine, ergot or preferably ergotin or sclerotinic acid by subcutaneous injection, and opium. Transfusion, or preferably the subcutaneous introduction of salt water (4–6 : 1000, introduced by two needles under massage), as in cholera, offers hope of rescue from death by loss of blood.

Patients the victims of intestinal (or gastric) ulcer must maintain a guarded diet for months, often for years, after all signs of the disease shall have disappeared, as the best prophylaxis against recurrence. Constant vigilance is also required to avoid constipation, and the greatest temperance exercised with regard to the use of alcohol. Sometimes a course of mineral waters, a sea voyage, or other change of life or scene constitutes the best means of avoiding frequent relapse.

It need hardly be said that an ulcer in the rectum, which is readily recognized by its attending tenesmus, calls for local treatment ; and it is equally plain that tuberculosis or syphilis demands appropriate address.

HÆMORRHAGE OF THE BOWELS.

General Remarks.—Hæmorrhage of the bowels occurs in both sexes, though more frequently in the male, and at all ages, though more frequently at the middle period of life. In the infant a form of it is sometimes considered as a distinct affection under the head of melæna neonatorum, and in age it sometimes shows itself as a distinct sign of a disease characteristic of age—namely, cancer. According to the tables of Bamberger it is caused, in the order of frequency, by dysentery, typhus fever, cancer (of the colon), mechanical injury, poisons and foreign bodies, ulceration (tubercular, follicular), the round ulcer of the duodenum, and aneurism; last and least frequent is the so-called vicarious hæmorrhage.

Etiology.—Hæmorrhage from the intestinal canal arises from (1) anomalies in the contents of the bowel, (2) disease of the wall of the bowel, and (3) from general diseases.

1. The inspissation of the natural contents of the bowel during long-standing or habitual constipation may convert the fæces into dense masses, which irritate and scratch the mucous membrane, and thus induce hæmorrhage directly by simple solution of continuity, or indirectly as the result of extreme hyperæmia. Such hæmorrhage is nearly always slight, streaking or coating the surface of the scybalous mass, or being extruded from the anus as a small deposit of blood during the last act of defecation; in which latter case it is found mostly associated with hæmorrhoids or fissure of the anus. Independent of these conditions, this hæmorrhage usually has its origin in the lowest region of the large intestine, where condensation of the fæces is naturally greatest.

Foreign bodies in the intestinal canal descended from the stomach may also be the cause of hæmorrhage in the same way. Thus, stones of fruits, bones of fish, fragments of oyster shell, or other substances in no way connected with aliment (false teeth, buttons, pins and needles, etc.), may be swallowed accidentally or purposely (as by children or the insane) to produce intestinal hæmorrhage. Drastic cathartics (podophyllin, gamboge, etc.) and poisons (arsenic, mineral acids) occasionally act in the same way. Tardieu reports the case of a servant to whom was administered, by a charlatan, veratrum with coffee, with fatal effect in six days. At the autopsy, made by Amussat and Reymond, the stomach and small intestine were found filled with a dark-brown or black, bloody fluid, but there was no trace of perforation, ulceration, or organic disease.

Under this head mention should be made also of certain parasites whose habitat is the intestinal canal, the walls of which they perforate. Two varieties, the Anchylostoma duodenale and the Distoma hepaticum, are frequent causes of hæmorrhage—the former from the

duodenum and jejunum, the latter from the rectum—in hot climates, more especially in India and Egypt.

2. Anomalies in the intestinal walls produce hæmorrhage as the result of intense hyperæmia (per diapedesin) or of actual loss of substance (per rhexin). Copious, even fatal, hæmorrhage has thus ensued from dysenteric and typhoid processes (and even without discoverable cause) where no ulceration or loss of substance could be discovered on autopsy; and this accident is so frequent as the result of ulceration in the disease mentioned as to constitute a characteristic sign or complication. It must be said, however, that cases of alarming or fatal hæmorrhage, without apparent cause during life or lesion after death, were more frequently reported in the literature of the times preceding our more accurate knowledge of pathology and pathogeny. Few clinicians or pathologists would now be content with reports made without full knowledge of the history of the case or microscopic examination of the intestinal walls. Thus, the report before the Société médicale d'Émulation, April 2d, 1834, by Dubois, of a young man who quickly died of intestinal hæmorrhage five days after a severe headache, and on the same occasion, by Guillemot, of several similar cases, would awaken the suspicion of masked typhoid fever; and the case of an old man aged seventy-four who died of intestinal hæmorrhage after four days' diarrhœa, reported by Husson, would call for a close examination of the vessels in the intestinal walls. In fact, Bricheteau, who reported a case from the Hôpital Neckar, was able on autopsy to discover a rupture in a small artery of the intestines.

Embolic processes leading to the formation of ulceration (by predilection in the duodenum) are often attended with intestinal hæmorrhage, which would be more constantly present were it not for the fact that, as in the stomach, the speedy establishment of collateral circulation prevents the consequences of complete infarction.

Besides dysentery and typhoid fever, tuberculosis and syphilis are occasional causes of ulceration and necrosis of the intestinal walls which may be attended with hæmorrhage. Cancer of the intestine most frequently affects the rectum, but wherever situated may show hæmorrhage as one of its signs.

The local hyperplasia of the mucous tissue which constitutes a polypus, and which in children, in whom it most frequently occurs, is mostly situated in the rectum, is suspected to exist or is recognized by the frequent discharge of blood from the bowels. A far more grave affection of the intestinal walls, likewise most frequent in childhood, is the peculiar dislocation known as intussusception or invagination. This condition is so commonly attended with distressing evacuations of blood and mucus as to simulate dysentery. The strangulation of the intussuscepted mesentery with its vessels easily accounts for the hæmorrhage in such cases.

A more extensive compression is exercised at times by tumors in the abdominal cavity, as by pregnancy, ovarian growths, etc.; occlusions in the course of the portal system (cirrhosis hepatis); interference with the general circulation, as in disease of the heart or lungs, with intestinal hæmorrhage as a consequence.

Diseases of the blood vessels themselves, as amyloid degeneration, aneurism, should not be omitted from the list of factors possibly productive of this result.

3. The general diseases attended with hæmorrhage from the bowel are characterized for the most part by more or less general disintegration or dissolution of the blood, with the manifestation of hæmorrhage in various parts of the body, kidneys, uterus, subcutaneous tissue, etc., the enterorrhagia being an accidental localization, so to speak, of the effusion. The most prolific causes of this disorganization are the micro-organisms, which "touch the life of the blood corruptibly"; and hence the various acute infectious diseases may show in the severer forms hæmorrhage from the bowels. Under this head may be ranged variola, which boasts even of a hæmorrhagic form; typhus, yellow, and malarial fevers; the forms of nephritis marked by uræmia; cholera, icterus gravis, erysipelas, etc. Disintegration of the blood or partial dissolution of its corpuscular elements occurs also in those obscure affections which constitute the group, or are included in the description, of the hæmorrhagic diatheses, as hæmophilia, leukæmia, pernicious anæmia, scurvy, of any of which enterorrhagia may be a distinct or dangerous sign.

Melæna neonatorum is the distinct name given to a hæmorrhage from the bowels which occurs a few hours or days after birth, and which is often so profuse as to cause death at once or in a short time. In most cases no anatomical lesions can be discovered after death, save an intense hyperæmia of the intestinal mucosa, so that the etiology of this affection is involved in obscurity. The various causes assigned in its production—ulceration of the stomach or duodenum (Bohn), embolism (Landau), fatty degeneration (Steiner), premature ligature of the umbilical cord (Kiwisch)—answer only for individual cases. Betz reports a case in a family subject to hæmophilia, and Trousseau once saw twins thus affected; but that heredity cannot account for all cases is shown by the fact that it occurs mostly in healthy children from healthy parentage. Klebs is inclined to attribute the affection to the action of micro-organisms, introduced perhaps as the result of puerperal infection; but this cause can be assumed in only a small minority of cases—at least but a small percentage of cases coincide with puerperal disease on the part of the mother.

The affection is fortunately rare. Eichhorst states that Hecker

observed it but once in five hundred births and Gemich but once in one thousand births. According to Rilliet the hæmorrhage is oftener (eight-fourteenths) intestinal, rarer (four-fourteenths) gastric, and rarest (two-fourteenths) both. It is almost always abundant and quickly repeated, the blood being mostly pure, in clots or masses and fluid, though it is sometimes commingled with meconium. It usually ceases within twenty-four hours, though it may continue for three, five, or more days. Of twenty-three cases reported by this author twelve recovered and eleven died.

Morbid Anatomy.—Hæmorrhage from the bowels, being only a symptom of very many different conditions, is marked by lesions characteristic of the condition in an individual case. These lesions are more appropriately described in connection with the various diseases. Not infrequently in these cases the intestine is distinguished by the absence of any lesion at all. But, from whatever cause, hæmorrhage from the bowels, like hæmorrhage from any other source, shows a more or less profound anæmia of all the internal organs, and in more chronic and protracted cases leads to fatty degeneration, more especially of the heart.

Symptomatology.—Hæmorrhage from the bowels is usually readily recognized by the *discharge of blood*, either pure or mixed with the natural contents of the alimentary canal. The actual seat of the hæmorrhage may, however, only rarely be recognized by the rectal speculum. The *colicky pains*, *borborygmi*, or sensations of fluids in the abdomen which are occasionally experienced may not be relied upon in fixing the seat of the effusion. Should the hæmorrhage occur in quantity, or, more especially, should the seat of the effusion be low in the intestinal canal, the blood which escapes is more or less pure. When the hæmorrhage is higher, or when the stay of the blood in the bowel is longer, it becomes more or less incorporated with the contents of the bowels or altered by the intestinal juices, to present a discharge of mushy or semi-fluid consistence, of dark-brown or black color. So-called *tarry stools* are thus largely composed of blood.

But serious, even fatal, hæmorrhage sometimes occurs without the escape of any blood at all. Such are the so-called cases of *concealed, occult, or internal hæmorrhage*, in which the nature of the malady is only suspected or recognized by the general symptoms attending the profuse loss of blood. Should the hæmorrhage be gradual, anæmia slowly supervenes, with hydræmia and subcutaneous dropsy. Traube reported a fatal case of œdema of the glottis from such a cause. Sudden hæmorrhage announces itself by *pallor and prostration, dyspnœa, vertigo, and syncope.* Amaurosis, tinnitus aurium, formication, emesis, and, if the disease be high up in

the intestinal canal, hæmatemesis, are the common attendants of serious hæmorrhage. In the worst cases of sudden effusion the patient may present the appearance of *complete collapse*, and the intestinal canal be found on autopsy distended with blood throughout a great part of its course, while no blood whatever has escaped from the rectum. In such a case, or with more gradual loss of blood, the patient experiences a sense of increasing weakness; the skin becomes cold, is bedewed with a clammy sweat; the pulse grows feebler, and death from exhaustion more or less speedily ensues.

Diagnosis.—The presence of blood in any quantity in the stools is readily recognized by its coarser characteristics. Ridiculous errors have been made by mistaking the coloration produced by bismuth, iron, logwood, etc., administered internally, or by coloring matters introduced into the discharges for purpose of deception. The microscope, Teichmann's test for blood crystals, and in extremely doubtful or medico-legal cases the spectroscope, furnish easy means of detecting blood in whatever quantity or character.

It is the cause and seat, rather than the existence, of the hæmorrhage that mostly produce embarrassment in differential diagnosis. Hæmorrhage from the lungs, nose, or stomach is usually readily excluded by the absence of any evidence of disease of these organs, and the presence of the other symptoms of any general disease attended with enterorrhagia makes a diagnosis in most cases easy enough. Alterations in the contents of the bowel, the presence of foreign bodies, are recognized by the history of the case and by careful local examination, while a diagnosis of anomalies in the walls of the bowel is usually reached by exclusion. In no doubtful case should local inspection or digital examination of the anus and rectum be omitted.

Treatment.—As in all cases of hæmorrhage, the first requisite is absolute rest. The patient should at once be put to bed and kept perfectly quiet. Many a case of hæmorrhage in typhoid fever is produced by arising from bed to go to stool. The bedpan is an absolute necessity in the management of a case of typhoid fever after the second week of the disease. Rest is the chief element in prophylaxis as well as therapy.

The most effective styptic in enterorrhagia is cold. An ice bladder should be laid upon or suspended immediately above the abdomen during the whole duration of the flow. The injection of ice water into the bowel should be practised only in cases where the hæmorrhage is believed to come from the colon, otherwise the peristalsis it awakens may only aggravate the danger. Should rest and cold fail to quickly check the hæmorrhage, resort should be had at once to ergot. This remedy, in the form of ergotin or sclerotinic acid, is most effective when introduced beneath the skin. In

cases of less imminent danger the practitioner may be content to give the remedy by the mouth.

Small doses of the simple or camphorated tincture of opium frequently repeated speedily arrest contractions of the bowel and at the same time feed the brain in threatening syncope. The astringents proper—tannic acid or its preparations, acetate of lead, alum, the perchloride of iron—are seldom necessary or advisable, but may be called for in obstinate or protracted cases.

To turpentine have been ascribed from time immemorial specific virtues in relief of hæmorrhage of the bowels, and its administration is still a routine system with many older practitioners. It is most effective in large doses—one drachm, with milk or in emulsion, every hour or two until the hæmorrhage ceases.

In relief of collapse, alcohol, ether, camphor, and musk are imperatively indicated, with the external application of heat; and in the treatment of the anæmia and hydræmia, the preparations of iron, including later the mineral waters which contain it. In the worst cases of sudden, alarming hæmorrhage the physician should not fail to practise the transfusion of blood, or preferably hypodermato-clysis with solutions of salt water.

Milk, including malted milk, is the best food and drink during the attack, and after it for some days or weeks. Chopped or scraped raw beef may substitute it later, while all farinaceous foods are to be strictly avoided for some time.

TYPHLITIS, PERITYPHLITIS, PARATYPHLITIS, APPENDICITIS.

History.—Typhlitis (τυφλός, blind)—inflammation of or about the head of the colon, more especially the vermiform process—is a disease of modern recognition. Individual cases have been reported as curiosities where foreign bodies or fæcal accumulations had excited inflammation in this part of the intestine, but it is undoubtedly to Dupuytren that the credit is due of having first individualized this disease as a separate affection. About the same time, 1827, Longer Villermay published his communications on the diseases of the vermiform process, to be followed in the same year by Mêlier and Hussar and Dance with observations on inflammation of the connective tissue in the region of the cæcum. These affections, which had been hitherto described as inflammatory tumors in the right iliac region, now received from Puchelt the distinct name perityphlitis.

Perhaps the most remarkable events in the history of these affections since this time are the contributions of Stokes and Petrequin (1837) on the value of opium in the treatment of perforation of the vermiform appendix; of Albers, who first distinguished the special form of typhlitis stercoralis; and of Oppolzer (1858–64), who set apart,

perhaps as an unnecessary refinement in differential diagnosis, a paratyphlitis, an inflammation of the post-cæcal connective tissue. Matterstock (1880) deserves especial mention for having given such prominence to anomalies of the vermiform appendix in the etiology of the affection ; and Kraussold (1881) has connected his name with the therapy of the disease by the boldness with which he expresses his convictions regarding the necessity of early evacuation, by incision, of inflammatory products, as first practised by Willard Parker in 1843. The affection is more common or has been more frequently reported in the United States than in foreign countries, and has been thoroughly treated by American authors, especially by Fitz (Transactions of the Association of American Physicians, 1886).

General Remarks.—Typhlitis, strictly speaking, is limited to affections of the cæcum and its appendix vermiformis ; perityphlitis implies an extension of inflammation to the peritoneal envelope of these organs ; while paratyphlitis signifies an involvement of the extraperitoneal and post-cæcal connective tissues. Both perityphlitis and paratyphlitis are therefore secondary processes, though they may, in exceptional cases, arise from affections of organs other than the cæcum, as from perinephritis, psoitis, vertebral caries, or as an expression of metastatic processes in pyæmia, septicæmia (puerperal fever), typhoid fever, etc.

Etiology.—Typhlitis and its allied affections or complications show especial predilection for the male sex and the period of adolescence. Nearly three-fourths (seven hundred and thirty-three) of the whole number (one thousand and thirty) of cases of perityphlitis collected from the literature by Matterstock were males, and this proportion holds good in infancy and early youth as well as in adolescence. The greatest number of cases, thirty-three per cent, occur at the ages of twenty-one to thirty ; next, thirty per cent, at eleven to twenty ; while the ratio gradually decreases toward both extremes of life. So the opinion is expressed with singular unanimity by all authors that these diseases pre-eminently affect the bloom of life.

The observation that typhlitis has so often been found to arise from disease of the vermiform process has led to a closer study of its anatomical relations, and developed the fact that this organ is subject to great variation in size, shape, and situation.

Normally the appendix vermiformis arises from the posterior interior aspect of the cæcum as a tube of the diameter of a goose quill and a length of three to six inches, with a general direction upward and inward behind the cæcum. It is commonly provided with a small mesentery, which retains it in its place. Its cavity communicates with the cavity of the cæcum by a small orifice which is at times guarded by a valvular fold of mucous membrane, while its free

closed end terminates abruptly in a blunt point. It is commonly found filled with mucus throughout its entire length. The existence of this superfluous structure, which is found only in man and certain of the higher apes, has given rise to much speculation among the anatomists and physiologists, especially of the teleological school, as to its possible use. It is now, however, the generally acknowledged opinion that the appendix vermiformis is a relic or rudiment of a subsidiary stomach in lower forms of life. The head of the large intestine, which forms almost an additional stomach in the gramnivora, is very much reduced in the carnivora, whose food contains but little indigestible matter, and is greatly reduced in the omnivora, as in man. The vermiform appendix is the shrivelled remnant of the great cæcal receptaculum of the lower animals. In the orang it is still a

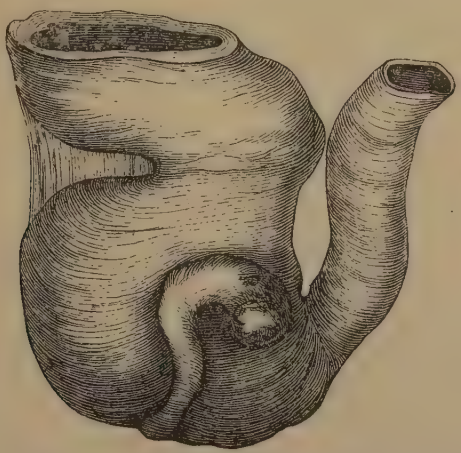


Fig. 187.—Typhlitis. Ulceration of the vermiform appendix (Kraussold).

long, convoluted tube, but in man it is reduced, as stated, to the size of a quill three or four inches in length, and is often entirely absent.

Kraussold, who complains that the vermiform process has hitherto received only stepmotherly treatment at the hands of anatomists and clinicians, undertook a series of investigations which went to show how often and what extreme anomalies do occur. In some cases the appendix was disposed in an exactly opposite to the normal direction, its blind end being turned upward along the ascending colon. In one case it was found wound about the ileum; in another, spirally turned at its end and lightly adherent to a hernial sac. Sometimes it was abnormally long or short, open or closed with a valve, cylindrical, saccular, or bulbed, fixed or free, curved or bent upon itself at a sharp angle, provided with a short mesentery, and sometimes, as stated, it was entirely absent.

But by far the most interesting point connected with this organ was the frequency with which it was found the seat of ulceration or stricture from cicatrization somewhere in its course, the result of dysentery, typhoid fever, syphilis, and more especially of tuberculosis. Clinicians who have been struck with the frequency with which typhlitis has occurred in tuberculous subjects find in this discovery a satisfactory explanation of this remarkable coincidence.

Normally the vermiform appendix is found filled, as stated, with a tough, vitreous mucus, but not infrequently masses of fæces, foreign bodies, intestinal worms, etc., find their way into it, where they remain innocuous or may excite a dangerous inflammation. This fact, in connection with the general uselessness or superfluousness of this structure, has led pathologists to distinguish the vermiform process with the significant appellation of a death-trap.

Two anatomical factors deserve especial emphasis in explanation of the frequent origin of disease in the vermiform appendix. One is the existence of the valvular fold of mucous membrane, already mentioned, at or near the orifice of the tube in the cæcum, the clinical importance of which was first pointed out by Gerlach. This fold is most marked between the ages of three and twelve, and when pronounced narrows the orifice to one-half or one-third of the whole calibre of the tube. As a rule this fold and the consequent diminution in the size of the orifice are but little marked in the first years of life and in old age, which accounts for the relative infrequency of typhlitis at these periods of life.

The second mechanical factor is the deformity caused by the abnormal anatomical position of the organ, either as a congenital defect or as a pathological change. Matterstock quotes from Züngel, who observed, in fifty-nine cases in the Hamburg Hospital, whole or partial obliteration thirty times, catarrh and old fæcal concretions forty-three times, abnormal adhesions twelve times, and actual ulceration (without perforation) eleven times. Toft claims as the result of three hundred personal investigations that every third person between the ages of twenty and seventy showed the traces of present or past inflammation, and that actual ulceration existed in five per cent of all bodies examined. Kraussold declares that this percentage is rather too low than too high, and adds that among his patients—who were, it should be stated, mostly phthisical—it was remarkable how extraordinarily often the whole vermiform appendix was the seat of an encroaching ulcer. In a number of cases cicatrices or cicatricial alterations were found where typhoid fever or dysentery had existed in the previous history.

Attention should at least be called to a last anatomical factor in explanation of the frequency of ulceration and inflammation of this

structure, in that its walls are so sparsely endowed with muscular tissue as to render it unable to empty itself of bacteria or organisms of disease which enter it from the comparatively stagnant reservoir, the cæcum.

Constipation is usually invoked as a cardinal factor in the genesis of typhlitis (typhlitis stercoralis). Speck calls attention to the frequency of the disease in East Siberia, where the food, mostly vegetable, contains a large amount of indigestible residue. But that this condition cannot sufficiently account for the disease in most cases is proved by the fact that constipation is more frequent in advanced life and among females, in whom typhlitis with its associate lesions is more infrequent. For the same reason a sedentary mode of life loses force as an argument in its production. Perhaps the most efficient cause of the condition is a local paresis of the muscular tissue of the cæcum, produced by the irritation of intestinal catarrh, of disease products, of a fæcal concretion or a foreign body —an irritation which may induce first a spasmodic action, and subsequently, as a result, a partial paralysis or a paresis. The same condition may be brought about more directly by the presence of a centre of irritation—viz., by reflex inhibition or innervation. Accumulation and impaction of fæces must then necessarily ensue, and it is highly probable that this accumulation occurs in this way as a result more frequently than as a cause of the condition. For the symptoms of a simple accumulation of fæces (coprostasis) are never so severe, at least at the start, as to mark the onset of a genuine typhlitis. Nor is there anything in healthy fæces to induce the signs of a severe blood poisoning, which so commonly announces the advent or course of typhlitis.

The rôle of pure mechanical causes cannot be ignored or underrated in true typhlitis, understanding by this term processes which commence in the vermiform appendix. For it is the rule to discover in the vermiform appendix in these cases either fæcal concretions or foreign bodies. Häckel and Buhl found concretions of meconium in a new-born child ; and fæcal concretions, intestinal stones, are far more frequently encountered than foreign bodies. In one hundred and forty-six accurately observed adult cases recorded by Matterstock, fæcal concretions were met with sixty-three times, foreign bodies nine times, while in the other cases nothing could be discovered ; and in forty-nine cases among children fæcal concretions were discovered twenty-seven times, foreign bodies three times, and nothing abnormal in the remaining cases. Not infrequently a small foreign body acts as a centre of crystallization for fæces, which become superimposed in successive layers. Hairs, as of the beard, sometimes officiate in this way. Among other foreign bodies met

with in fatal cases of perforation, independently of fæces, may be mentioned round worms (Faber), cherry stones (Paterson), needles (Payne), fish bones (Züngel), gall stones (Hallete), a mass of ascarides (Klebs), buttons (Gerhardt), etc., etc. As already intimated, supposed foreign bodies are often found on examination to be nothing else than intestinal concretions. As to cherry stones, which are so often accused of producing typhlitis, Biermer and Bossard found it difficult or impossible to force them into the vermiform process.

Symptoms.—Typhlitis announces itself in two ways, suddenly and insidiously. In adults the disease begins, as a rule, with violent signs; in children there is often a prodromatous stage, which may last for days or for months before a positive diagnosis can be established. There are in these cases anorexia and vomiting, constipation and diarrhœa, colicky pains, mostly concentrated about the ileo-cæcal region. There is at this time *a disinclination to stand or walk, a stooped posture or gait, occasionally a light icterus, a feeling of formication or paresis in the right thigh.*

In the adult the disease is wont to begin with more tempestuous signs. Not infrequently it is ushered in with a well-marked *chill*, upon which immediately supervenes a sharp pain at the affected region. A general collapse of strength soon follows, with fever, thirst, a husky voice, a coated tongue, vomiting, singultus, and an expression of anxiety. The impression of serious illness becomes apparent at once. The case early bears the *aspect of a grave infectious disease.* A constant, dull, boring, gnawing, or lancinating *pain in the right iliac region* first excites the suspicion of the physician as to the real nature of the disease. In children the pain is sometimes felt first in the epigastrium; in three cases mentioned by Büchner, Herzfelder, and Traube it was first experienced in the left ileum. There may be at this time no tumor, but there is increased resistance to pressure and exquisite tenderness to touch in the neighborhood of the cæcum. A particular point of tenderness on a line toward the umbilicus, two to two and a half inches from the anterior superior spinous process, is known as McBurney's point, and is considered characteristic of true typhlitis, though with little reason, considering the anomalies of the appendix. The whole abdomen may be more or less tender and often tumid. If there should be also gurgling from displacement of gas, doubt is excited as to the possible existence of typhoid fever. In the course of a few days the *tumor takes shape.* A typhlitis stercoralis shows a distention of the whole ascending colon, a sausage-shaped tumor, smooth or nodulated, along the entire right side of the abdomen, with increased resistance also in the transverse colon. More frequently in typhlitis, and as a rule in peri- and paratyphlitis, the tumor or tumefaction is more *localized*

about the head of the colon. Frequently the swelling is so great as to be visible as a protrusion or bulging of the affected region. Percussion shows *dulness,* tanquam femoris, in cases of pure typhlitis, whereas in paratyphlitis there is tympanites on light and dulness only on deep percussion. Palpation or palpatory auscultation occasionally, though very rarely, reveals a peritoneal friction sound (Gerhardt).

The third cardinal symptom of the disease is the *disturbance of digestion,* which, as stated, often precedes or attends the first manifestation of the pain and the tumor. Anorexia, nausea, and vomiting—which is, in the last stage of the disease, often substituted by *singultus*—present themselves as occasional or constant signs of the disease. *Constipation* remains, as a rule, throughout the whole course of the disease with an obstinacy which sometimes excites apprehension of an intestinal occlusion ; or the constipation may *alternate with diarrhœa or dysenteric phenomena,* more especially in the earlier stages. The tongue is, as a rule, heavily coated, or in typhoid states is dry, glazed, or fissured, and sordes covers the teeth and gums.

Fever is not a necessary factor in typhlitis, but when present distinguishes itself by its irregular range. The pulse is usually accelerated, full, and hard ; the skin is dry and harsh ; the urine is scanty and high-colored, and contains, "almost without exception, unusually *high quantities of indican*" (Eichhorst).

Perforation, when it occurs, is usually recognized at once by the signs of more or less immediate collapse, which quickly results in death. The abdomen becomes suddenly distended, meteoric over its entire surface. The normal hepatic dulness may give place to tympanitic resonance.

Not infrequently perforation occurs as the result of an accident, as after a push or blow upon the abdomen (Volz), heavy lifting (Volperling), riding in a wagon (Downs), after emesis (Urban), purgation (Stokes), enema (Mêlier), etc., etc. That the slightest agitation may suffice at times to break down the last barrier of serous tissue separating the intestinal and peritoneal cavity is shown in the case recorded by With, where fatal perforative peritonitis occurred after a fit of immoderate laughter.

Paratyphlitis distinguishes itself from the other forms of the disease by its more insidious character. There is also in paratyphlitis, as a rule, less disturbance in the alimentary canal. *The cœcum in paratyphlitis is mostly empty, or is filled with gas* whose presence is recognized by tympanitic resonance on lighter percussion. On the other hand, paratyphlitis is characterized by the *greater frequency of pressure signs in the right lower extremity.* If the

subjacent iliac and psoas muscles be implicated the thigh is flexed upon the leg in decubitus. Various *parœsthesiæ*, formication, numbness, pain, and veritable paresis are experienced in the right leg. *Dysuria, retraction of the testicle, and priapism* may also occur in this form of the disease. Or pressure upon the iliac vein induces *thrombosis, with œdema, milk leg.* The long-continued process of suppuration in paratyphlitis leads also at times to hectic fever or *pyœmia, with slow marasmus.*

In all cases relapses are very frequent, and repeated recurrence of the disease constitutes the rule. Eichhorst records the case of a court officer who suffered five attacks of paratyphlitis in the short space of one and a half years.

Morbid Anatomy.—The lesions revealed upon the post-mortem table show for the most part the ordinary picture of perforative peritonitis, which is by far the most frequent cause of death. The peritoneum in the vicinity of the perforation is found hyperæmic, swollen, necrosed, covered with flakes or soft fibrin, or partially agglutinated to contiguous structures. The wall of the bowel is very much thickened by catarrhal swelling of its mucosa, proliferation of its submucous tissue in more chronic cases, œdema of all its coats, or suppurative processes. Not infrequently the mucous tissue is the seat of extensive ulceration, which may involve other structures of the gut or form an abscess, even as large as a man's head, in its immediate vicinity. The abscess may remain strictly localized, or may wander to discharge itself into the ileum, cæcum, duodenum, and diaphragm (Bamberger) with resultant empyema (Duddenhausen) ; colon (Prudhomme) ; bladder (Bossard), in which case the fecal concretion became the nucleus for a vesical stone ; acetabulum (Aubry) ; inferior vena cava (Demaux) ; or peritoneal cavity, the most frequent eventuality. Duddenhausen saw in one case a pylephlebitis result ; Von Buhl a pylephlebitis and metastatic liver abscess, which condition, Matterstock says, is noted eleven times in one hundred and forty-six autopsies ; and older writers speak of discharges into the pleural sac, into the lungs, pericardium, uterus, vagina, etc. A curious case was observed by Eichhorst in Frerichs' clinic, where pus found escape through the umbilicus. So cases of burrowing sinuses with abscesses at distant seats, as in the groin or lumbar region, fistulæ with continuous discharge, and other curiosities, may be found among the records by the curious.

In cases of more acute course the lesions are found centred about the vermiform appendix. The most various contortions, adhesions, or erosions are observed in this structure. Occasionally a constriction occludes the course of the tube, while the distal end is dilated into a condition of hydrops. It may be found perforated in one or

several places. The cicatrices or agglutinations of old attacks may be encountered; it may be cut in two or three pieces (Matterstock), or have been entirely absorbed. Kraussold records a case of this kind in a colleague who died of typhlitis. Upon the post-mortem table no trace of the vermiform appendix could be encountered, except a dimple on the mucous surface of the cæcum indicating the site of its former orifice.

Diagnosis.—Though sometimes *latent* for a long time, the recognition of the disease is usually simple. The age, the sex, the pain, the tenderness, the tumor, and the disturbances of digestion sufficiently, and for the most part sufficiently early, distinguish the affection.

Simple impaction of fæces is differentiated by the history of constipation; by the feel of the hardened fæces, which form an elongated, nodulated, sausage-shaped tumor along the entire ascending colon, shifting later along the transverse colon; by the comparative slight tenderness; and by the entire relief which follows thorough irrigation of the bowel. Perforation from typhoid fever occurs late in the disease.

Cancer may be eliminated by regard of the age of the patient, the slow development and course of the symptoms, and the gradual manifestation of its cachexia.

Invagination is an affection for the most part of early childhood, is marked by the sudden appearance of violent symptoms of disturbance of digestion, vomiting, often stercoraceous, occlusion, diarrhœa, or dysentery, with straining and discharges of blood.

Gibney reported a case of confusion with hip-joint disease.

Duration.—Typhlitis with its various complications has no definite duration. A case may terminate fatally in the course of a few days, or may extend itself over months, or with its effects over years or for life. The disease is, as a rule, much shorter in childhood than in adult life. According to Matterstock nearly one-half (forty-four per cent) of children succumb to the disease within the first three days. Wood records the case of a girl aged ten who died in nine hours. The average duration of cases of typhlitis without suppuration ranges from fourteen to twenty-one days. The early evacuation of inflammatory products by incision and exsection may cut the disease short at any time, or exacerbations and remissions may manifest themselves for months or years—a condition especially liable to occur when burrowing sinuses or fistulæ develop, or when passive encapsulated abscesses are aroused into activity by some accident or indiscretion on the part of the patient.

Prognosis.—A case of typhlitis stercoralis has no gravity, and should terminate or be terminated within twenty-four to forty-eight hours after its recognition. Neglected or unrecognized cases, how-

ever, are not infrequently fatal from the circumscribed or more especially diffuse peritonitis which may ensue.

Typhlitis independent of fæcal impaction is always a grave infection, requiring in every instance a very guarded prognosis.

Every form of typhlitis is more fatal in childhood than in adult life, and any case of the disease may present grave complications or assume a dangerous form at any time. The greater danger of childhood lies in the greater liability to peritonitis. Most subsequent writers confirm this statement, first made by Willard Parker, who also remarked that suppurative processes, abscess formation, is more common in the adult. The mortality of appendicitis alone in childhood is seventy per cent, in adult life thirty per cent, so that the proportion of recoveries is exactly the reverse of these figures at the different periods of life.

The general adoption of the opium treatment has, however, rendered the prognosis of typhlitis far more favorable—has, in fact, reduced the mortality in adult life from eighty per cent, the appalling figures of the older statistics (Volz), to fifteen per cent, the ratio of modern times.

The means of earlier detection and readier relief of appendicitis or evacuation of accumulated pus have also contributed much to reduce the mortality of typhlitis. In 1872 Bull, of New York, had to report of sixty-seven cases of perityphlitic abscess collected by him, mostly treated without operation, a mortality of forty-seven and one-half per cent, while ten years later Noyes, of Providence, was able to report of one hundred cases treated by operation a mortality of only fifteen per cent (Pepper).

The development of fistulæ or wandering abscess, the occurrence of pyæmia and peritonitis, necessarily aggravate the prognosis of a simple case. Perforation is fatal almost of necessity, yet cases are not wanting where recovery has occurred even after this gravest of all the accidents of the disease. Thus, Patschkrowski reports from Frerichs' clinic a case of recovery after perforation; and Pepper mentions the results of an autopsy made upon an old man who died of vesical hæmorrhage, in whom he "found that there had, at some unknown previous time, been perforation of the appendix."

Prophylaxis.—The prevention of typhlitis has reference more especially to cases of habitual recurrence of the disease in adults or to the earliest, prodromatous stage in childhood. The slightest manifestation of pain in the right iliac region should be looked upon with suspicion in these cases and absolute rest enjoined at once. Since in childhood perforation has occurred in insidious cases after so slight an irritation as a laxative or an enema, or even after a bath, every provocation of this kind should be avoided. Injunction

is to be put upon all solid food in all cases, in the inception as well as throughout the course of the affection, that the element of coprostasis be not superadded. Adults subject to frequent recurrence or relapse may thus avoid the development or aggravation of an intestinal catarrh, which in other cases of trivial import may become dangerous to them. Many cases of typhlitis are doubtless aborted at the start by the observance of absolute rest and abstinence from food or rigid diet at the start.

Treatment.—Perhaps no disease requires such careful consideration of its cause or form, inasmuch as the different varieties call for entirely different treatment. A typhlitis stercoralis, for instance, requires an exclusive evacuant treatment, whereas a peri- or paratyphlitis demands a laparotomy or a treatment that shall put the bowel at rest.

The safest and most effective method of emptying the cæcum of impacted fæces is by irrigation of the bowels by means of the funnel syringe devised by Hegar. The patient is put in the knee-elbow or face-chest posture, "as Arabs pray," and warm water—which is the best solvent for hardened fæces—is allowed to slowly inundate the whole tract of the colon. Feeble or reduced patients should be supported in this posture until as much water as possible is slowly introduced. As a rule a single thorough irrigation will suffice, or one or several additional operations may be required to secure the desired effect. At the same time broken doses, twenty grains, of sulphate of magnesia may be administered every hour or two, not so much for the purpose of exciting additional peristalsis as of turning water into the intestinal canal from above. The indiscriminate habit of purging all cases with Epsom salts, recommended by the gynæcologists, is to be deplored. Very different conditions prevail in peritonitis from typhlitis and uterine disease (salpingitis). In the one case the bowel is, in the other the bowel is not, affected. Purgation which secures osmosis is beneficial in salpingitis, but injurious in typhlitis. Where the bowel is itself inflamed purgation is bad practice.

The other varieties of the affection call for opium at the start, with the double view of preventing the irregular, spasmodic, or tetanic contraction of the muscular coat and of obviating the danger of peritonitis. Opium is not contra-indicated in these cases, even if the element of fæcal impaction be superadded, as all clinicians are familiar with the fact that the bowels will move of themselves at times even under its full narcotic effects. The remedy is best given in fluid form, as in the tincture, that the dose may be graduated in its repetition to secure its full effect without danger ; and it is to be remembered that opium, with all its active principles, is of more

value in the relief of peritonitis than morphia alone. The idea that opium does harm by "masking the symptoms," as advanced by the gynæcologists and surgeons, is unfounded in fact. Opium masks no symptom but pain. A careful watch should be kept upon all patients treated with large or frequently repeated doses of opium, that its toxic effects be avoided. Not infrequently symptoms of poisoning have supervened after a sudden relief of pain, necessitating the use of means to keep the patient awake for a number of hours.

Hot embrocations or poultices applied over large surfaces of the abdomen give great comfort to the patient, though the very opposite treatment by an ice bag, occasionally shifted or suspended, is more agreeable in some cases in the inception of the disease.

So soon as a distinct doughy sensation or a more marked fluctuation indicates the development of pus, steps should be taken at once to secure its evacuation. In cases of doubt it is best to make a tentative exploration with the needle of the aspirator, a large-sized needle being preferred on account of the liability of occlusion with tissue shreds or other débris. It is quite surprising how rapidly a case clears up at times after the evacuation of even only a drachm or two of œdematous fluid. More frequently, however, a laparotomy must be performed and the abscess completely discharged. An abscess of more superficial situation, of larger size, or of continuous formation is best relieved by free incision. As to the time of the operation, the old rule, *ubi pus ibi incisio*, holds good here as elsewhere. An early evacuation of the products of inflammation prevents the supreme danger of perforative peritonitis or the formation of burrowing sinuses, fistulæ, amyloid degeneration, and marasmus. Indurated tumors are sometimes made to soften under the long-continued use of cataplasms, and chronic thickenings of the walls of the intestine are relieved by general tonics, mild laxatives, mineral waters, and gentle frictions with iodine or mercurial ointments.

Perforative peritonitis calls for immediate laparotomy, which is most successful when not too long delayed, *i.e.*, beyond the third day (Fitz). It is, however, not true that laparotomy is imperative in all cases of typhlitis. Judgment must be used here as elsewhere. The surgeon is too often and too directly followed in certain cases by the undertaker. Literature abounds in cases where delay in operation (laparotomy) has permitted natural resolution. The frequently and rapidly recurrent cases point most strongly to the necessity of exsection, though even in these cases it may be a question if it be not wiser to suffer a week or two once a year or once in several years. Relapses occur also after laparotomy.

Under no circumstances should a patient affected with typhlitis

leave his bed until the last trace of inflammation has subsided, as there is always liability to recurrence or relapse.

INTESTINAL OCCLUSION.

The writers of antiquity used the terms ileus and volvulus to describe many and very varied diseases of the intestine. Volvulus has become limited in our day to that peculiar torsion upon its own axis which the intestine sometimes undergoes, and which is the rarest form of intestinal occlusion; while ileus has come to be used as a generic term to express occlusion from whatever cause. *Miserère* was a term often used by the older clinicians to express the agony caused by this condition. Occlusion of the intestine is naturally a clinical expression based upon a gross anatomical state. The state may arise from a multitude of causes, but the general result will be the same. Occlusion of the intestine necessarily implies a state of obstinate and prolonged constipation, usually in this condition termed *obstipation*. Constipation is in itself a relative condition. According to the teachings of physiology the intestines should be evacuated once in twenty-four hours, usually after the break of the fast in the morning. Peristalsis is started in the stomach with the ingestion of food, to propagate itself along the entire course of the intestinal tract, and thus to secure the evacuation of any matter in its lowest parts. Evacuation once a day would constitute with some individuals an abnormal state; once every other day, twice a week, once a week, are conditions often noticed. Instances are upon record where the bowels have not been evacuated for a month, for two months, for even three months, without danger.

1. The tendency of civilization is more and more toward the state of *constipation*. In the first place, life becomes more and more sedentary; women are constipated almost as a rule.

In the second place, food is more and more completely digested by the *cuisine*, so that the amount of indigestible residue which may alone traverse the whole course of the intestinal canal becomes less and less. The life of man becomes also more and more sedentary. In-door avocations increase with the advance of civilization. Animal food prevails more and more. All these things tend to render the bowels sluggish and to produce states of constipation. Preoccupation of the mind is a notorious factor. The concentration of business and professional avocations diverts nerve force from the intestinal canal as well as from the stomach. A fine illustration of this effect is noticed in the insane, whose intense preoccupation leads to neglect of the natural functions. The large intestine becomes enormously dilated in these cases, and stretched so that the transverse colon may present a distinct M shape.

Hypochondriacs are nearly always constipated. While constipation is a relative condition, the state is absolute in an individual, and the condition produces distinct discomfort. There is flatulence with borborygmi and eructations of gas; colicky pain from distention; dyspepsia; at times, from the irritation of accumulated masses, dysenteric phenomena. There is malaise, depression of spirits, not infrequently evidence of disturbed circulation in the peripheral vessels, acne about the face, hæmorrhoids, etc.

Constipation is usually relieved by appropriate treatment of the cause, as by the regulation of exercise, a daily walk or ride on horseback, some kind of gymnastics, massage and faradization of the abdomen, enemas; by address to conditions of the blood, as to chlorosis or anæmia, by iron, belladonna, strychnia; in amenorrhœa by pills which contain aloes, the official pill of aloes and iron, arsenic, etc. Sometimes a teaspoonful of Carlsbad salts in a glass of hot water before breakfast will suffice. Then resort must often be had to vegetable matters; the simplest are fruits and oatmeal. The compound pill of rhubarb, calomel, cascara sagrada, a minute pill of podophyllin gr. $\frac{1}{4}$–$\frac{1}{2}$ at bedtime, are effective laxatives; lastly, the slow injection and retention until morning of a pint of *pure* olive oil every night. When constipation becomes obstinate, whether of slow or sudden development, it is an obstipation and constitutes a marked factor in the history of occlusion of the intestine. An occlusion may be caused simply by accumulation of fæces, the so-called *coprostasis*, or, when especially marked at the region of the cæcum, as typhlitis stercoralis. This condition may be usually recognized by palpation, which reveals a sausage-like mass in the course of the colon, sometimes by touch of the finger introduced into the rectum. Occasionally the diagnosis may be established only *ex juvantibus*—that is, by prolonged and repeated irrigation of the bowels in the knee-elbow posture.

2. The occlusion may result also from a *foreign body*—coins, buttons, fruit stone, marbles, teeth, parts of the insertions of teeth, hairs, fragments of cotton, dirt, all kinds of foreign matters taken purposely or accidentally, especially by children and the insane. Most foreign bodies pass. Fragments of oyster shell pass, as a rule, in the course of time, creating often much mischief by the way. More angular particles, pins or needles, may do destructive damage by perforations of the intestine, peritonitis, or the formation of sinuous tracts, burrowing fistulæ, abscesses, etc. The *insoluble drugs* in continuous administration, iron, bismuth, magnesia, may form concretions in the intestinal canal. All these substances, however, sink into insignificance, so far as foreign bodies are concerned, when compared to *gall stones*, which constitute the most frequent cause of intestinal occlusion. Gall stones from one to three inches in

length and diameter escape from the gall bladder by process of direct ulceration into the transverse colon, and are passed along fitfully, locked up at times in the intestinal sacculæ, dislodged under a more powerful peristalsis, as a rule to be entirely discharged, but not infrequently of themselves, or as a centre for fæcal matter, to become direct causes of occlusion.

3. Confining the causes to the bowel itself, there is next to notice *stricture*, as a rule from ulcerative process. Typhoid fever, tuberculosis, and dysentery are the diseases which most frequently produce ulceration in the intestinal canal or cicatrization. Typhoid and tuberculous ulcers seldom contract the lumen of the bowel. On the other hand, dysenteric ulcers frequently narrow the bowel, and almost exclusively, of course, the large intestine. Syphilis and carcinoma are perhaps the most frequent causes of stricture. In both cases the diagnosis may be made, as a rule, by the introduction of the finger. In both cases the lesion is usually situated in the rectum and within reach of touch.

4. Passing next to extrinsic causes, the first condition to be noticed is that of *internal strangulation*. In all cases of occlusion careful search must be made for the common forms of *hernia*, in the elimination of which it may be necessary to make rectal and vaginal examinations. The intestine is sometimes strangulated by passing through natural or acquired perforations of the mesentery, as, for instance, the foramen of Winslow, orifices in the mesentery, meso-colon, omentum. Sometimes a loop of intestine slips under the lower edge of the elongated mesentery, low in the pelvis, or insinuates itself under the pedicle of an ovarian or uterine tumor. The most frequent cause of strangulation is that which occurs as the result of inflammation, especially of tuberculous character, whereby *bands of false membrane* are formed or abnormal adhesions. A knuckle of intestine may slip under an arch formed by adhesion in the tip of the vermiform appendix, or parts of the intestine may be nipped or compressed by agglutinative inflammation. Under this head belong also the cases of *obstruction from compression*, as by tumor, uterine or ovarian, aneurism, retroperitoneal gland, etc.

5. Volvulus, torsion of the bowel upon itself, implies some defect in innervation which disturbs the tonicity of the gut. Cases have been reported where a volvulus, after being untwisted, twisted back upon itself.

6. The most frequent and strange of all the accidents which occur to the intestine are the so-called *invaginations or intussusceptions*, a process which has been coarsely likened to a telescoping of the gut. This condition implies also some defect in nutrition or innervation, whereby a ring of the gut becomes paralyzed, to permit

the upper portion to slip into its interior. Invagination of the intestine is most frequently observed in childhood, one-half of all the cases under the age of seven. As a rule the small intestine slips into the large, or the ileo-cæcal valve leads the way, or the lips of the valve glide into the ascending colon and in the extension of invagination drag down successive portions of the colon. In adult life, where the condition is much more infrequent, the ileum may be intussuscepted into itself, or more rarely the jejunum into the ileum; rarest of all, the ileum is intussuscepted through the ileo-cæcal valve. In the process of invagination two peritoneal and two mucous coats come in contact. The part of the bowel which begins the intussusception continues always the lowest part, and the extension of the process takes place at the expense of the intussuscipient gut, so that in the ordinary case the lips of the ileo-cæcal valve advance through the ascending colon, across the transverse colon at the expense of the ascending colon, down the descending colon at the expense of the transverse colon, to finally protrude, sometimes in an elongated mass, at the anus. If the process were a simple telescoping, with apposition of two serous and two mucous membranes and a maintenance of the lumen of the bowel, it would not do so much damage. Unfortunately, however, this is not all of the process. The mesentery is dragged in with the descending gut, so that its lumen comes to lie against the wall of the receiving gut. Moreover, the vessels in the mesentery are blocked. Necrosis sets in and the intussuscepted gut sloughs. This process may take place quickly, so that the invaginated gut may be discharged in twenty to thirty days, sometimes by the end of the first week; or, again, it may be protracted for a year or more, with the continuous danger of occlusion or of pyæmia and marasmus. Recovery occurs, however, in about half the cases. According to the statistics of Brinton, of every hundred cases of intestinal obstruction forty-three are cases of intussusception, twenty-seven of internal strangulation, seventeen of stricture, five of impaction of gall stones, eight of torsion or twisting.

Symptoms.—Besides the *constipation* referred to, occlusion at the intestine announces itself by severe *pain*. The pain is usually paroxysmal in its severity, though more or less continuous—paroxysmal because it exhausts the nerve centres for a time. Violent *tormina* characterize nearly all cases. *Tenesmus*, with straining at stool and the discharge of bloody mucus, is more especially characteristic of intussusception. *Vomiting* occurs in all cases. It is usually excessive, often stercoraceous, and may with its repetition so harass the patient as to entirely prevent sleep. It would seem as if nature made the effort to overcome the obstruction by the discharge above of a large quantity of fluid matter. The fluid, finding no

egress, must be ejected from the mouth. Vomiting grows in frequency and severity as the occlusion approximates the stomach. Stercoraceous vomiting indicates occlusion of the large intestine. Valuable information is furnished by the action of the kidneys. The *urine* is often remarkably *reduced*, and the reduction stands in relation to the situation of the block. Occlusion high in the course of the canal most markedly reduces the quantity of urine. Various explanations have been offered to account for this fact. Barlow thought that the scantiness of urine was due to the fact that there was left no surface for absorption. Brinton attributed it to the profuse vomiting, which discharged the fluids of the body in this way; Sedgwick to shock, which is most marked in cases of high occlusion. Valuable information may be at times derived from the discovery of *indican* in the urine. In cases of high occlusion the amount of indican is increased—that is to say, the indican does not undergo the subsequent changes which eliminate it from the bowel. Indican reveals itself sometimes by the blue color of indigo, which may be especially observed in decomposing urine. More frequently the color of the urine is normal and the indican must be disclosed by chemical test. To a quantity of urine in a test tube is added an equal quantity of fuming nitro-muriatic acid, and to this fluid three, or at the most four, drops of a concentrated solution of chlorinated potash, whereby the deep-blue color of indigo is produced. A few drops of chloroform added to this mixture, which is then gently agitated, carry the blue color with a deposit of the chloroform to the bottom of the tube.

The *condition of the abdomen* itself furnishes the next information. Distended over its whole course and markedly tympanitic everywhere means usually occlusion in the course of the large intestine. Distentions limited more particularly to the upper region of the abdomen, with collapse of the lower region, indicate occlusion of the small intestine. The *percussion note, the discovery of masses, solid or gaseous, by palpation,* indicate to some extent the situation and character of the lesion.

The *diagnosis* of the existence of an occlusion is, as a rule, sufficiently easy. Occlusion must be separated from typhlitis, coprostasis, and peritonitis. Typhlitis shows a circumscribed mass in the region of the cæcum, with at times symptoms of pressure in the right lower extremity. Sooner or later an abscess may be discovered in the course of the disease. Coprostasis is relieved by irrigation or by hydragogue laxatives. Peritonitis shows fever, dulness to percussion at the sides of the abdomen, pain in micturition, absence of fæcal vomiting. The cause of peritonitis may often be discovered.

The discovery of the cause of occlusion is unfortunately more difficult. Age, gradual development, cachexia, may speak for cancer, which may be recognized by the touch in the rectum or by palpation of the surface. Previous attacks of jaundice in females past the meridian of life speak for occlusion from gall stones. A previous attack of dysentery may lead to the discovery of stricture. The injection of water into the colon may locate the stricture. The depth to which a rectal bougie may be introduced may also furnish information.

It is easy to multiply words in the differential diagnosis of occlusion of the intestine. No field of medicine is more obscure. Diagnoses which are made by guess or which are based upon statistics fail oftener than they succeed in an individual case.

The *prognosis* is always grave and takes color wholly from the nature of the lesion.

Treatment.—Laxatives in the early treatment of the condition may not be pushed too far. "It is easier to untie a knot," Leichtenstern says, "by gentle than by forcible means. Forcible means often make it tighter." Purgatives may lacerate the bowel and produce fatal peritonitis. An intussusception may at times be overcome by the injection of water or air. A stricture may be dilated with the bougie. The contents of the stomach may always be discharged by the stomach tube. This process prevents extreme tension, lessens peristalsis, puts the intestine at rest, and favors the chance of recovery where recovery is possible. This method, which is officially known as Kussmaul's, was really first used, practised, and published in Cincinnati five years before the report of Kussmaul's cases.

The classical treatment of occlusion is the administration of opium in doses which put the bowel at rest. Opium is given preferably in the form of tincture, and close watch is kept upon its effects. Hot applications are usually made to the surface.

Radical treatment resolves itself into a question of laparotomy, a question which may be decided only by a consultation of physicians in an individual case.

CANCER OF THE INTESTINES.

The intestine is one of the rarer seats of carcinoma. It is affected, in fact, in but four to eight per cent of all cases of cancer. The disease is four times more frequent in the large than in the small intestine, and is seated in the rectum in eighty per cent of all cases. It is next most frequent at the flexures of the colon. The cancer is commonly primary, and subsequently invades the peritoneum, mesentery, and retroperitoneal glands, or sends a metastatic deposit to the

liver. Sometimes this relation is reversed: the disease of the intestine is secondary to that of the liver.

The form is usually scirrhus. Colloid comes next, and colloid cancer has been recognized in matter in the fæces before the development of symptoms (Charon, Ledegank). Sarcoma is still more rare. Lympho-sarcoma may extend to the rectum from neighboring lymph glands, and melano-sarcoma or carcinoma may develop in the intestine (only in the rectum) by metastasis from the eye or skin.

Scirrhus of the rectum constitutes, as stated, the most common form. The deposit is, as a rule, more or less circular. It forms an encroaching ring which constricts, finally occludes, the lumen of the gut. Peripheral extension gives rise to agglutinative inflammation, which finally converts contiguous structures into an indurated mass. Ulcerative processes, degenerations, and dissolutions bring about the same destructive changes as at other seats. Cancer is rare before forty, and occurs in both sexes with equal frequency.

Symptoms.—The disease develops very insidiously, and frequently exists for months unrecognized. Disturbances of digestion, more especially *alternating constipation and diarrhœa, the dysenteric phenomena, tenesmus, bloody mucus,* etc., with *gradual but progressive degradation of vigor,* announce its onset as a rule. Patients are commonly treated for chronic intestinal catarrh, or for hæmorrhoids, or, especially in women, for affections of contiguous viscera, especially the uterus and ovaries. The obstinacy of the symptoms to treatment leads finally to examination of the rectum, with, as a rule, the immediate recognition of the nature of the disease. This examination should be made early in cases of chronic intestinal disease, for the reason that cachexia develops later in carcinoma of the intestine than elsewhere. The same remark applies also to pain. The *form of the fæces* is often characteristic. Frequently the fæces are compressed into bands or rods, which alone may pass the constricted regions. Tape-like, lead-pencil, sheep-balls, are terms applied to matter so compressed. Naturally this alteration of form refers simply to anatomical change, which may depend upon various other, often outside, causes. Far more characteristic is the *discharge of decomposing, highly offensive matter* mixed with blood and pus, in which, in rare cases, *cancer masses* themselves may be detected and disclosed. A *tumor* may tell the story to the touch.

Duodenal cancer would show the same symptoms as cancer of the pylorus—to wit, *dyspepsia, vomiting, and dilatation,* with *icterus* at times in addition. Perforation produces the symptoms of more or less sudden collapse. Perforation of the bladder leads to the discharge of fæces, intestinal gases, etc., with the urine.

The *diagnosis* really rests upon the recognition of the constriction by the finger introduced into the rectum, where the disease is accessible ; in higher regions of the intestine, by the detection of a tumor by palpation. In consequence of the peculiar attachment of the intestine the tumor often changes place, may at times disappear, and, in upper regions of the intestine, may be, by pressure, considerably displaced. The presence of icterus with normal acidity of the gastric juice speaks for duodenal rather than for pyloric cancer. Fæcal masses may be usually removed by copious irrigation. Tumors of the kidney and mesentery are situated behind the intestine. Circumscribed or inspissated peritoneal exudations, as after typhlitis, which most closely resemble cancer, may be often distinguished by the age of the patient and the previous history of the disease. Sometimes a diagnosis may be quickly reached after free irrigation and under chloroform narcosis. The use of chloroform is especially of value in cases of rectal cancer, where examination is attended with pain. An obscure case may justify the excision of a fragment from the rectum for microscopic examination. The ratio of frequency helps the diagnosis. In eighty per cent of all cases of intestinal cancer the disease is in the rectum, in fifteen per cent in the cæcum and colon, in five per cent in the intestine. The *prognosis* is fatal. The *treatment* is wholly symptomatic and surgical.

PERITONITIS.

Inflammation, usually infection, of the peritoneum.

History.—Knowledge of the existence of peritonitis as an independent disease dates from the beginning of the present century, and is due largely to contributions of Laennec, Corvisart, and Broussais. Louis, in the first quarter of this century, recognized the fact that spontaneous or idiopathic inflammation of the peritoneum is very rare. Peritonitis is regarded at the present time as a secondary malady. Cases of so-called primary peritonitis become rarer every year, and are accounted for, in the absence of mechanical cause or extension of inflammation from contained or contiguous viscus, by the action of poisons, micro-organisms or their products, circulating with the blood and lymph.

Etiology.—In the majority of cases peritonitis may be accounted for by obvious cause. As commonly encountered, it is most frequently due to, or consequent upon, inflammation of the uterus and its adnexa. Thus, circumscribed peritonitis is a frequent sequence of salpingitis (gonorrhœa), and general peritonitis is a common and grave complication of the puerperium. The next most frequent cause is hernia. Hereupon ensue, in the order of frequency, ulcer and cancer of the stomach ; diseased processes of the intestine, es-

pecially typhlitis, typhoid, dysenteric, tuberculous, carcinomatous ulcers of the intestine; subsequently, diseased processes of other organs and viscera, liver, kidneys, spleen, mesenteric glands, etc. Aside from the local processes, many of the acute infections develop peritonitis. Pyæmia and septicæmia, especially septico-pyæmia, scarlet fever, small-pox, erysipelas, and rheumatism may beget the disease, usually late in their course. Scurvy, various hæmorrhagic maladies, especially Bright's disease, make the peritoneum vulnerable. Peritonitis is distinguished, according to its extent, as circumscribed and diffused; according to its intensity, as acute and chronic. Peritonitis marked by the rapid accumulation of gas from perforation of a hollow viscus is distinguished as pneumo-peritonitis. Metastatic deposits from tuberculosis and cancer produce tuberculous and cancerous peritonitis.

Symptoms.—Pain is the most prominent symptom. It is localized or diffuse, according to the situation or extent of the diseased process. It is usually *acute and intense*, and is associated with an expression of *extreme anxiety;* the weight of the bedclothes must be lifted from the body. The pain is intensely aggravated by motion. The action of the diaphragm is hemmed in inspiration. *The act of urination, especially at its close, is attended with severe pain,* due to traction of the contracting bladder, paresis of which *reduces the quantity of urine.* The *abdomen soon becomes distended, meteoric,* partly from accumulation of gases, partly from paresis of the abdominal walls. The natural dulness of the liver and spleen may be substituted by tympanites. This distention of the abdominal cavity displaces the thoracic viscera; the lungs may descend no lower than the fourth or fifth ribs; the heart is dislocated upward and outward. Whether from mechanical cause or toxic effect, there is *vomiting and singultus, with obstipation of the bowels.* Acute peritonitis is attended with *fever,* which may or may not be present in chronic forms. The pulse is small and frequent, the respiration is rapid, the features are pinched and anxious, and thus the patient falls into rapid collapse.

The *diagnosis* rests upon the recognition of the cause. The disease must be distinguished from hysterical states with hyperæsthesia of the abdominal walls. The age and sex of the patient, the absence of perception of pain on diversion of the mind from the seat of the disease, together with the signs of hysteria—to wit, globus, convulsions, absence of pain on deep pressure—usually suffice to separate the maladies. The pain of gall stones and kidney stones, cardialgias and colics, is not aggravated by motion and is unattended by fever. Pneumoperitonitis is recognized by the rapid distention with gas, tympanites on percussion, high stand of the diaphragm, intense

pain, and rapid collapse. The *effusion* of peritonitis is distinguished from that of common ascites, as withdrawn in either case by aspiration, by the higher specific gravity in peritonitis, above 1012, and by the presence usually of flocculi, or by greater turbidity, etc. Bloody, purulent, or ichorous fluid betokens tuberculous or cancerous peritonitis. Aid is furnished in the recognition of these forms by the discovery of outside evidence of tuberculosis or cancer. The diagnosis of tubercular affection, which most chronic cases are thus shown to be, is quickly made with tuberculin after the manner already described. The author has never yet been deceived or disappointed with this method in this disease. In one case the diagnosis thus established was verified by laparotomy. The *prognosis* is always grave, but takes color largely from the cause.

The *treatment* consists in arrest of the spread of the disease. This object is chiefly to be accomplished by rest, with the use of opium. Opium with all its constituents is better than any one of its active principles. The drug is often given in peritonitis in the form of the tincture. The dose may begin with twenty to thirty drops, and be repeated every hour or two until it produces its effects. There is in peritonitis singular tolerance to opium. Nevertheless caution must be exercised, and the pupils and the breathing watched, that with the subsidence of pain the patient be not left narcotized. Cold, in the form of ice bags, may be applied only at the start. Greater comfort is secured later with hot applications. Perforative and tuberculous peritonitis justify laparotomy and drainage, which may be made more or less continuous with the physiological salt solution, one drachm to the quart, sterilized and warmed.

CHAPTER IV.

DISEASES OF THE LIVER.

ICTERUS.

THE liver is the largest gland in the body, and has perhaps the most numerous and most varied functions to perform, yet it is seldom the seat of disease. It is said that the liver is more sinned against than sinning. Of the affections of the liver proper—abscess, cirrhosis, cancer, echinococcus, amyloid and fatty degeneration—very few belong to the liver alone. Abscess is generally a part of pyæmia or the result of a deposit from dysentery. Cirrhosis occurs in consequence of alcoholism and is associated with other lesions produced by alcohol. Echinococcus is a parasite; it may lodge anywhere in the body, and comes to affect the liver simply because of its proximity to the stomach. Fatty and amyloid changes are degenerative processes in consequence of suppuration, syphilis, tuberculosis, etc.

Jaundice, which is commonly considered as the sign of disease of the liver, is not an indication of disease of the liver at all. Jaundice seldom or never occurs in any of the diseases of the liver just mentioned. When it occurs in these diseases it is accidental. It does not belong to them, and the presence of it rather excludes than admits them. Jaundice is simply a symptom of occlusion of the bile ducts from any one of twenty or thirty causes. The worst kind of occlusion of the gall ducts may show a clear skin, and disappearance of the tint of jaundice during the existence of this occlusion may be a most ominous sign. It may result from non-formation of bile, suppression and not retention—a condition which speedily terminates in death. Jaundice is therefore not a disease; it is only a symptom of many diseases. The symptom is, however, entitled to special consideration, first, because it is so obtrusive as to be recognizable by everybody; second, because it is in its most frequent form produced by a distinct cause—namely, catarrh of the bile ducts; third, because in its graver forms it requires a nice study of a great number of diseases to discover the cause in an individual case. The light of a

great many diseases is focussed upon jaundice; hence jaundice has always been considered an interesting symptom to study.

The question of the production of jaundice outside the liver is largely a matter of definition. It has long been claimed that the discoloration of the skin noticed in certain cachexias, or more especially in certain infections and pyæmic processes, etc., constitutes a particular form of jaundice whose cause was located in the blood. It was assumed that this so-called hæmatogenous jaundice existed independently of any affection of the liver, and lines were drawn by which distinction could be made between *hæmatogenous* and *hepatogenous* jaundice. The conditions could never have been brought in the same consideration, were it not for the fact that the coloring matter of the blood is nearly identical with that of the bile. For cases of hæmatogenous jaundice are due to disintegration of blood corpuscles and liberation of coloring matter. In these cases there is no question of decolorization of the fæces or colorization of the urine—conditions requisite to constitute a true jaundice. Consequently the separation of hæmatogenous from hepatogenous affections has little or no real practical interest. When, in the course of the infections or poisonings, the coloring matter of the bile is shut off from the intestine, to be reabsorbed and excreted by the urine, true icterus has occurred.

Icterus neonatorum is always a true icterus. It shows itself in nearly all cases of enfeebled children. Plump, healthy, robust infants at birth maintain a reddish hue or have it substituted by the tints of healthy flesh. Infants not so strong have the reddish hue of birth substituted often by yellowish tints of the skin and mucosæ. The coloration passes off in the course of a few days or weeks. Should it, however, persist longer than two or three weeks, it assumes a deeper hue, marasmus sets in, fever, with grave nervous symptoms, and there is presented the picture of icterus gravis. The light, canalicular catarrh or occlusion by inspissated mucus, which causes the milder forms, has now been substituted by organic change which has led to complete atresia of the bile ducts—a condition which is sometimes congenital.

History.—Jaundice comes from the French word *jaune*, yellow. The Germans call the disease, from their own word for yellow, *gelb*, *Gelbsucht*, the yellow disease. The technical is the Greek term, *icterus*. The Greeks called icterus a disease. Aretæus derived the word from certain yellow-eyed, four-footed terrestrial animals called iktides. Pliny derived it from a bird called icterus, the sight of which cured the patient but killed the bird. This bird is now believed to have been the golden oriole. Suidas takes it from ἴκτινος, a kite which has, according to De Haen, yellow eyes. The Romans

called it *morbus regius*, from the yellow color of gold, the *rex metallorum*.

The bile played a most important part in ancient pathology. The Grecian fathers had many varieties of bile. Aretæus spoke of white and black bile. Icterus albus, icterus ruber, icterus cœruleus, were names for chlorosis, erythema, and cyanosis. The bile flowed about the body curiously in ancient pathology, to account for many diseases. It was especially responsible for mental diseases and depressions. Melancholia means black bile ; hypochondriasis refers to the liver "under the cartilage."

Symptoms.—The *color of the skin* varies in all degrées of intensity in jaundice, from a light, almost imperceptible tinge to a deep-mahogany hue. Once distinctly manifest, it varies in shade, but preserves its main color throughout the disease. In lighter deposit it is most manifest about the forehead, the roots of the hair, so that it may escape recognition in a man with his hat on in the street. The tint is diffused over the body, but is most marked on the flexor surfaces. The bile is deposited also in the various mucosæ, but the tint is hidden by the deeper color of the blood, to become manifest only under pressure which removes the blood, or in thin mucous membranes. It may be seen always *in the conjunctiva*, and, though invisible on the lips, *shows itself on the hard and soft palate.*

The cause of jaundice is occlusion of the bile ducts. In consequence of this occlusion the gall bladder and liver become at first distended, while the bile is absorbed by the blood and lymph vessels to be distributed over the body. It is soon visibly present in the urine, which, too, varies in every shade in correspondence with the amount of coloring matter it may contain. *A true icterus always stains the urine*, and the diagnosis of the condition rests largely upon this fact. The deeper color of the urine becomes apparent at a glance. Agitation of the vessel containing it shows a foam, persistent and distinctly colored. Spread in a thin layer over a porcelain plate and stroked with a glass rod dipped in fuming nitric acid, it shows *a play of color, an iridescence* from oxygenation. The test is usually made by pouring a small quantity of nitric acid into a test tube and adding to it one or two drops of fuming nitric acid. A layer of the urine is let fall upon the side of the glass from a pipette. When there is much bile pigment the surface of contact of the two fluids shows a ring of green, violet, and red. A smaller amount of bile is detected by filtering the urine and pouring upon the filtrate a mixture of nitric and nitrous acids, whereby the colored rings form as before. There are finer tests, but these suffice for all clinical purposes. Pettenkofer's test for bile acid, which consists in adding a solution of cane sugar 1 : 500 and a trace of

concentrated sulphuric acid to the urine, whereby a violet-red color is shown, is of but little value. The color is clearly exhibited only when the bile acids have been isolated. The detection of bile acids in the urine has, anyhow, but little diagnostic value. Small quantities can be detected in normal urine.

Occlusion of the bile ducts shuts the bile off from the intestinal canal; consequently the *fæces lose their color*, to become lighter. Moreover, under the exclusion of bile the fats are no longer digested. They appear, therefore, pure or partially decomposed, to impart their own color to the stools; hence in a case of complete occlusion *the stools assume a putty-like appearance and consistence.* Watery stools almost never show any of the ingredients of bile. The water of these stools comes from the blood. *True jaundice implies, therefore, a coloration of the skin and mucous membranes, also distinctly of the urine, and a decolorization of the stools.* This collection of signs protects against deceit and simulation. Where the face has been colored, as by saffron or a turmeric, the color may be removed with soap or with a chlorine solution or chlorinated lime. The mucous membranes show no tint and the urine is not discolored. When the urine is discolored, as by rhubarb and santonin, the color will be converted into a deep-red hue by an alkali, which will only make browner the urine of jaundice. Moreover, in these cases the stools show no absence of color. The real secretions of the body—tears, saliva, sweat, milk—are never colored, or only so rarely as to constitute curious cases. Peculiar yellowish deposits, which may assume something of tubercular aspect, show at times on the skin in protracted cases, at first in the eyelids, later over the face and the rest of the body, to constitute the condition known as xanthelasma. Yellow vision, xanthopsia, is a much more infrequent curiosity.

The accumulation of bile in the blood, and the effect of its contact with the nervous system, produce a distinctive train of symptoms aside from the coloration of the skin. In rather more than half the cases the sensitive nerve fibres in the skin are irritated to produce itching. *Itching occurs in jaundice in sixty-eight per cent of cases*, and exists in all grades of intensity. It is at times so severe as to excessively harass the patient and exhaust the strength from want of sleep. It shows itself, as a rule, most intense on the palms of the hands and soles of the feet and between the toes, and may extend to involve any surface of the body. It is usually *worse at night*, and is, as a rule, when it shows itself, so severe as to call for special treatment. The spirits are depressed. More or less *mental hebetude and dulness* belong to jaundice. There is also a train of dyspeptic symptoms, in connection more

especially with *flatulence and constipation*, which belongs to the condition. *The pulse is often reduced in frequency* to fifty, forty, thirty strokes in the minute. Frerichs counted twenty-eight in one case and twenty-one in another. The reduction is ascribed to the direct action of the bile salts upon the ganglia in the heart. There is, along with the dulness and depression of spirits, *more or less drowsiness*, a tendency to sopor, which in a bad case deepens into coma. The urine usually shows albumin as well as bile; irritation of the bile pigment and salts may excite nephritis. There may be found in the urine of jaundice occasional hyaline casts.

Where the condition continues and the occlusion becomes permanent the symptoms show greater gravity. From lack of digestion of fats and other foods there sets in a *gradual marasmus*, and patients who have been jaundiced for many months or years more or less progressively emaciate. There is with this emaciation corresponding loss of strength, manifest in the force as well as in the frequency of the heart's action. Œdema of the ankles and dropsy may later supervene. The gravest symptoms show themselves on the part of the nervous system. Stupor, convulsions, delirium, coma, occur toward the last.

Diagnosis.—Jaundice being only a symptom, the question arises at once as to its cause. Jaundice alone indicates, as stated, simply occlusion of the bile ducts. What causes the occlusion? Recent cases, more especially in the young, are accounted for by *simple catarrhal swelling of the mucous membrane.* The bile flows under very light pressure; gravity and the *vis a tergo* force suffice to secure its discharge. A slight swelling of the mucous lining in the bile ducts will shut off its escape. The inflammation begins often in the stomach, to extend into the duodenum and involve the orifice of the bile ducts. Many cases are, therefore, expressions of simple gastro-duodenal catarrh. More frequently catarrhal inflammation affects the bile ducts themselves, and may extend from the orifice of the common duct in the duodenum to the gall bladder on the one hand and to the lobes of the liver on the other.

The bile ducts are blocked by a swollen mucous membrane, and more *especially by plugs of inspissated mucus*, which, in consequence of bile, is dammed back in the liver or gall bladder. The *gall bladder* swells to present *a palpable tumor* at times, which may give rise occasionally to a deep-seated sense of fluctuation. The liver itself is enlarged, though, as a rule, not to any very great degree. With the absorption and distribution of bile over the body the liver is wont to become subsequently reduced in size. The bile in the gall bladder becomes wholly absorbed, to be substituted by pure mucus, so that the contents of the gall bladder may assume something of a

gelatinous consistence and water-like clarity. This is the common form of catarrhal jaundice, which presents itself frequently in the young and disappears in the course of two to six weeks.

The next most frequent cause of occlusion is *impaction of a gall stone.* The stone may be wedged in the common duct, or wedged in the neck or duct of the gall bladder in such a way as to make pressure upon the common duct. Cases are on record where the jaundice has disappeared while the impaction and occlusion remained—cases in which agglutinative inflammation has taken place between the gall bladder and the small intestine, with subsequent perforation and escape of bile.

FIG. 188. — Distended ductus choledochus: probe *a* passed from empty gall bladder into distended duct; probe *b* from ductus choledochus into hepatic duct (Frerichs).

The gall ducts are occluded next by *outside pressure,* as by *carcinoma of the stomach,* liver, pancreas, omentum; sarcoma or other affection of lymph glands; by the cicatrization of an ulcer in the duodenum, or in the course of the bile ducts themselves; by all kinds of tumors in the

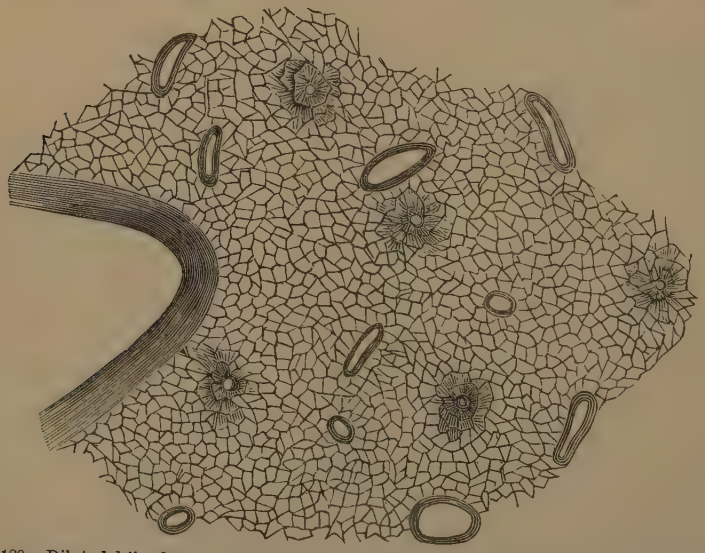


FIG. 189.—Dilated bile ducts with thickened walls under pressure from cancer of pancreas; smaller openings of hepatic veins, surrounded by cells deeply stained with bile (dark shading).

abdominal cavity; by abscess from caries of the vertebræ; by aneurism; by various causes, which must be worked out in an individual case.

The *prognosis* depends upon the cause. It is favorable in catarrhal jaundice, not unfavorable in gall stones, which may at least be exsected, comparatively unfavorable in ulcer, absolutely unfavorable in cancer, and dependent in cases of abscess, echinococcus, syphilis, cirrhosis, when it occurs in the course of these diseases, upon the direction or extension of these processes. Occlusion from swollen lymph glands may be entirely relieved with absorption of these glands.

The *treatment* of catarrhal jaundice consists in the administration of gentle laxatives, whereby states of hyperæmia, catarrh, at least of the duodenum, may be largely relieved. A sort of routine practice consists in the administration of Carlsbad water, or a teaspoonful of the Carlsbad salts in a glass of hot water, before breakfast Stadelman has lately shown that alkalies in small quantity have no effect upon the flow of bile, and in large quantity hinder it, so that the known virtue of the alkalies must consist in the increased alkalescence of the blood, whereby the bile is made more fluid. Rhubarb, aloes, tamarind, are various laxatives recommended. The diet must be simple. There is naturally an aversion to fats, which should be avoided altogether. The food should be mainly vegetable—this food is, indeed, chiefly craved by the patient—with abundance of drinks, more especially carbonated drinks, Apollinaris, Vichy, Selters water, etc. The treatment consists in the support of the patient until the catarrhal element shall have subsided or the plug of mucus which blocks the tubes shall have been discharged. Gerhardt proposed to discharge this plug by faradization of the gall bladder, and successful cases have been reported, as exceptions, however, to the rule. It has been recommended also to express the obstacle with the hands, to seize the gall bladder and literally squeeze out its contents. This procedure is for the most part impracticable, as the gall bladder may not be seized in this way, or dangerous when it may be seized, because of friability and possibility of rupture. Much safer and more effective is the plan proposed by Krull. This method consists in the injection into the bowel of one to two quarts of cold water every morning before breakfast. The temperature of the water should be 59° or 60° F., and may be increased to 65° or 68° in the course of subsequent treatment. Usually the water is discharged in five to ten minutes. The rationale of the treatment is ascribed to reflex contraction, whereby the gall bladder extrudes the plug of mucus which blocks its calibre. The injection must be repeated every day. The desired effect is sometimes accomplished after the second or third treatment, oftener not until after the sixth or eighth treatment. Whatever the explanation, the treatment is certainly successful in a very respectable contingent of cases. Sometimes it

causes colicky pains, and in delicate or sensitive persons it may even produce a chill, in which case, upon the subsequent occasion, the water should be warmer. The treatment is so simple, and the natural course of the disease is so protracted, that it should always be given trial first.

CHOLELITHIASIS.

Cholelithiasis (χολή, bile, λίθος, stone); gall stones.—The most frequent, severe, and dangerous disease connected with the liver is that produced by the formation and discharge of gall stones.

History.—A condition so gross as the presence of gall stones could not escape the observation of the earliest observers. It is not surprising, therefore, to learn that gall stones were discovered in the human body as soon as dissections were made. Folligno at Mantua, Tornamira at Montpellier (1586 to 1600 A.D.), are credited as having been the first anatomists to have seen gall stones in the human body. Fallopius and Vesalius certainly described them, but they seem not to have been matters of common recognition by all physicians until in the course of the seventeenth century, and the pathology of the affection was not at all understood until the eighteenth century. Morgagni, in his famous work "De Sedibus et Causis Morborum," made full description of the condition, but it could not be said that any definite knowledge existed concerning it until the chemists Fourcroy and Thénard discovered cholesterin, the chief constituent of gall stones. In the earlier half of the eighteenth century Andral, Budd, Trousseau, Frerichs, and Murchison illuminated the clinical aspects of the subject, and in the year 1851 Fauconneau-Dufresne published an exhaustive monograph with reference to nearly all the cases published up to that time.

General Properties.—Gall stones result not from mere thickening of the bile, as is commonly believed, rather from precipitation of certain substances normally held in solution in the bile. They exist for the most part to the *number* of five to ten in the gall bladder, and remain often, in whatever number, entirely quiescent, to produce no symptom whatever and to be discovered only upon autopsy. In exceptional cases the number is very great—the greater the number the smaller the size. Frerichs counted once 1,950, Morgagni 3,000, Otto 7,802, in one gall bladder. However numerous, they are nearly always of the same construction and vary but little in *size* and composition in the same gall bladder. They differ in less than four and one-half per cent of cases. The largest is that reported by Meckel, six by two and one-half inches. Stones vary in size from a grain of sand to a pea, hazelnut, walnut, or a cast of a dilated gall bladder. One such reported by Fiedler measured twelve centimetres and

weighed forty-six grammes (one and one-half ounces). There is not so much variety in *shape*. Gall stones are for the most part polyhedral, with numerous facets and rounded edges. Gall stones of very different shape and thickness are much more rarely found in the liver itself. They appear here as granular masses, but not infrequently assume the shape of the elongated ducts in which they are found, to look like black and shining slate pencils; or present the appearance at times, more frequently in the lower animals, much

FIG. 190.—Two large gall stones from the gall bladder articulated by smooth surfaces (Frerichs).

more rarely in man, of branching coral. Gall stones formed in the liver easily escape from the tubes, which gradually increase in size toward the hepatic ducts. Tubular concretions with canals like straws were discovered in a case reported by Briquet, following the ramifications of the bile ducts to their finest branches. Gall stones show also great variety in *color*, from grayish-white to nearly black.

FIG. 191.—Faceted gall stones, natural size (Ziegler).

The prevailing tint is some shade of brown, the color of the bile pigment. For the most part they *feel* greasy to the touch, being smooth upon their faceted surfaces; they may, however, be rough like a mulberry or show various erosions like a carious tooth. They may often be crushed between the fingers and nearly always nicked with the nails. Containing much lime, they may be as hard as stones. The *weight* of a gall stone depends largely upon its freshness. Old stones from which the fluid is evaporated float upon water. Fresh

stones exceed in weight the specific gravity of the bile, so that they seldom float upon its surface. A gall stone is usually *constructed* of a nucleus, body, and crust or rind. The nucleus may be formed of coloring matter with lime, or of a foreign body—a fruit stone, a round worm or other parasite, a needle, globule of mercury after administration of this drug. Nuclei of foreign bodies are very rare. The nucleus is usually mucus, upon and in which cholesterin is deposited. Curiosities are reported where the nucleus has been doubled or tripled. The body of the stone is made up chiefly of *cholesterin* with coloring matter. It is usually homogeneous or amorphous, with a fracture like soap, and has the consistence of soap. The *crust* is, as stated, usually smooth. It is sometimes studded with warty projections. It, too, is made up of cholesterin in smooth layers deposited horizontally at an angle thus to the body of the stone. Sometimes it contains lime salts.

Gall stones are formed nearly entirely, seventy to eighty per

Fig. 192.

Fig. 193.

Fig. 192.—Section of compound gall stone with concentric laminæ and with nucleus formed by a smaller gall stone (Frerichs).

Fig. 193.—Section of gall stone with concentric nucleus; concentric laminæ only at one end (Frerichs).

cent, of cholesterin. Normally the bile contains but little cholesterin, 0.015 to 0.025 per cent. This substance is very slightly soluble, and is held in solution by the alkaline salts of the bile. Coloring matters, bile acids, fatty acids, and lime salts form, as stated, the chief additional constituents of gall stones. Stones composed wholly of cholesterin are rare. They vary in size from a pea to a cherry, are colorless or show a grass-green hue. The surface is usually smooth and the fracture glistening; they are very light. Pure pigment stones are rare. They are generally small and very numerous, often mulberry-shaped, with shining fracture, and homogeneous like tar. They sometimes contain copper. Exclusive lime stones are very rare. They are nearly always single, whitish-gray in color, very heavy, and very hard, rough, and warty upon the surface.

Etiology.—Especial interest attaches to the *formation* of gall

stones. What causes the precipitation of the cholesterin? Upon this subject there are various views. 1. Cholesterin accumulates in abnormal quantity. What lends support to this view is the fact that cholesterin is a product of retrograde change, a process which increases with advancing age, and gall stones are found more abundantly after the middle period of life. 2. The natural solvents of cholesterin are diminished. Thénard finds the deposit due to diminution of the soda salts. Bramson ascribes it to an excess of lime, which substitutes soda and thus diminishes the solvent power of the cholate of soda. They support this argument with the statement that the coloring matter of the bile constitutes the nucleus of so many stones. 3. The alkalinity of the bile is diminished by catarrh of the gall bladder. The bile has a tendency to become acid under

FIG. 194.—Section of cholesterin stone after removal of cholesterin.

meat diet, and gall stones are found with greater frequency in high livers and in the upper classes of society. Support is lent to this view also by the fact that catarrh of the gall bladder is so frequently found in connection with gall stones. The catarrh may, however, be a result as well as a cause. Ebstein declares that gall stones contain a skeleton work of mucus, in the interstices of which cholesterin plates come to be deposited. This view of the genesis of gall stones, as the result of precipitation of the cholesterin from catarrh of the bladder, has at the present time the best support.

The irregular appearance of gall stones, the faceted surface, is not due to attrition, as is commonly believed, but to the special relations of numerous stones crowded together in the same cavity. Cholesterin deposits itself in the interstices between the originally more or less globular casts, so that the angular or polyhedral form

necessarily results. It is undeniable that gall stones undergo erosion and disintegration in the gall bladder. Sometimes they split with radiating fractures, and these are processes in pathology which art attempts in vain to imitate. Gall stones eroded in this way present the appearance of carious teeth, and the destruction is believed to be brought about in the same way, by the action of micro-organisms. It is not believed by any chemist that any solvent may be brought to bear upon gall stones in the body.

Gall stones have been discovered at every *age*, but are found in greatest abundance toward, at, and after the period of maturity. Of three hundred and ninety-five cases collected by Hein, but fifteen were under twenty-five and but three of these under twenty—to wit, sixteen, seventeen, and eighteen. There is universal testimony to the effect that gall stones prevail among women, and the proportion of prevalence in the *sexes* is usually put as 3 : 2. Fürbringer put it as 4 : 1, Bollinger as 5 : 2. This disproportion is usually ascribed to the sedentary life, and more particularly to constriction of the region of the liver in the mode of dress. In one hundred and eleven cases thirty-seven had constricted liver (Bollinger). It is well known that whatever interferes with the outflow of bile, whatever condition leads to stasis or stagnation, favors the precipitation of insoluble or slightly soluble substances. Hence gall stones are more frequently observed in sedentary lives and in the upper classes. Gall stones are rarities in hospital practice. Benneke has called attention to the frequency with which gall stones are found in connection with atheromatous change and excessive development of fat. What relation these conditions may have toward each other is unknown. They are probably coincidents of age, retardations of the activities. Glisten noticed that cows suffered with gall stones during the winter when confined and fed on hay, and passed them in the summer when let out to pasture on grass.

In the majority of cases gall stones *remain entirely quiescent* during the whole of life. Fortuitous circumstances may, however, at any time dislodge them and force them into the gall ducts. Here they meet with obstacles at once, as but the smallest stones, one-fifth to two-fifths of an inch in diameter, may ever pass through even a dilated duct. Fiedler declares that stones only as large as a pea can pass. Hyrtl says a stone as big as a finger, Budd as big as an almond, may pass. But modern observers maintain that the larger stones must either remain in the gall bladder, become wedged in the tubes to block them, or be discharged by perforation of the gall ducts. Individuals thus pass gall stones through abnormal openings between the gall bladder or ducts and the small or large intestine. Large stones pass always in this way. Individuals discharge gall

stones often without a sign of occlusion. These stones, as stated elsewhere, may alone, or especially when cemented *en masse* with fæcal matter, subsequently occlude the intestinal canal. Thus gall stones may pass through fistulæ into the stomach—a rare diversion; more frequently into the duodenum, more rarely into the colon. As curiosities they may meander, to be discharged into any part of the ileum, into the bladder and be evacuated with urine, into the pelvis of the kidney, through fistulæ upon the outside of the abdomen, accidentally into the interior of the portal vein, much more frequently into the peritoneal cavity of the abdomen, to be followed by the contents of the gall bladder and to produce death by perforation peritonitis in the course of a few days.

Symptoms.—However free from symptoms when quiescent, gall stones produce in their discharge a distinct train of signs—first, *pain.* Gall stones may be discharged by unnatural routes, as stated, without any or with but little pain. As a rule, however, the passage of gall stones along the course of the ducts is attended with most excruciating pain. It sets in suddenly, as a rule, and two or three hours after a meal. The pain irradiates from the region of the gall bladder, especially upward toward the shoulder, sometimes down the arm, most frequently toward the angle of the right scapula. These pains, as stated, are atrocious in their severity. Women, who suffer so frequently from gall stones, declare that the pains of labor are not to be compared with the pain of gall stones. As the stone comes to rest the pain may cease, to recur with its renewed advance. The pain ceases suddenly when the stone either drops back into the gall bladder or secures its escape into the duodenum. *Jaundice* is by no means so universally present. It is never present at the start. Stones which plug the common duct must necessarily show jaundice. The persistent cases of jaundice with deep mahogany discoloration, with marasmus, and later with nervous signs, belong much more distinctly to carcinoma than to gall stones. In fact, of forty-five cases accurately studied by Wolff jaundice existed in but twenty, and in but thirty-one of forty-one cases recorded by Fürbringer, so that the diagnosis of gall stones must be made without jaundice in rather more than half the cases. When jaundice does show itself in cholelithiasis, it develops rapidly, so that it may be complete and intense in twelve hours after the beginning of the attack. The coloring matter of the bile may show itself in the urine—sometimes in the absence of recognizable icterus—in less than twelve hours (Naunyn).

Dyspeptic symptoms, eructation, anorexia, nausea and vomiting, constipation (eighty per cent of cases), belong to the usual history of gall stones. As a rule *the liver is enlarged.* It may be

felt below the edge of the ribs. It is sensitive to pressure, and the gall bladder may be recognized as a fluctuating tumor or a large, pyriform mass. Sometimes, but rarely, gall stones crepitate.

The *diagnosis* of gall stone is for the most part easy. The sex, more particularly the age, of the individual are most important factors. Supreme in symptomatology is gall-stone colic. A history of repeated attack often declares the nature of the disease. Jaundice may or may not be present ; in the majority of cases the diagnosis, as stated, must be made without it. Cholelithiasis may be sometimes disclosed in the history of intestinal occlusion, or as the cause of fatal peritonitis or of complications of various kinds produced by meandering stones. The sex, the age, the pain, the jaundice when it exists, and with the jaundice the putty-like stools, deep-colored urine, itching, insomnia, slow pulse, nervous symptoms when present, make the diagnosis sufficiently easy. The pathognomonic evidence is the discovery of gall stones in the stools, and the diagnosis is indeed sometimes established in this way in the absence of all other signs. So the condition has been recognized by accidental discovery, or more particularly after a course at a watering place where irrigation of the blood and inundation of the gall bladder have dislodged and discharged smaller stones. In all cases *the stools must be passed through a sieve*, and every discharge must be examined for a week after an attack.

In differential diagnosis *gastralgia* must be distinguished and excluded. Gastralgia occurs for the most part in younger females, or in individuals of either sex affected with other neuroses, migraine, intercostal neuralgia, etc. The pain in gastralgia is more strictly epigastric, that of cholelithiasis hypochondriac. The attacks may be nearly equally severe and attended with the same precordial distress and anxiety. There is, as a rule, a longer interval between the attacks of gall-stone colic ; gastralgia is more or less persistent. Attacks of gall-stone colic are aggregated in time in connection with a discharge of individual stones. The other symptoms of gall stones —jaundice, presence of stones in the fæces, etc.—are of course absent in gastralgia. It is questionable if the liver be affected with a special neurosis. Budd and Frerichs maintained that the liver suffered the same neuralgias as the stomach, intestine, or other viscera. Hepatalgia, if it exists, would be separated with more difficulty than gastralgia, because the pain in neuralgia of the liver would express itself in the right hypochondrium. Where the diagnosis rests upon this single symptom it must often be held in abeyance. Consideration of the other symptoms, when present, separates the affections.

Ulcer of the stomach shows pain more continuous, as a rule more circumscribed, and more directly connected with the taking of

food. In ulcer there is hyperacidity of the gastric juice. Icterus speaks for gall stones.

Very difficult at times is the distinction between gall stone and *cancer*. Primary cancer of the gall bladder or of the liver in such situation as to compress the bile duct is rare. Cancer secondary to affection of the stomach is the rule. A previous history of cancer of the stomach, more especially the discovery or the recognition of a tumor distinctly palpable and separable from an enlarged or dropsical gall bladder, is a sign of great importance. Blood in the stools may occur in either or neither affection. It is more wont to occur in affection of the liver than in gall stone. The discovery of secondary deposits of cancer rarely assists in the diagnosis. Colic, if present at all, is not so severe in cancer. Aspiration of the gall bladder and withdrawal of bile indicate only compression or occlusion without regard to cause. The author made the first diagnosis by means of a needle used as a sound. The long, fine needle of the aspirator of Dieulafoy's apparatus was pushed into the neck of the bladder, and the stone was found distinctly palpable to the touch. A surgical confrère subsequently exsected a large mass completely blocking the tube. The introduction of a *clean* needle in this way is unattended with any particular pain or danger, though objections have been urged by inexperienced littérateurs. Age is comparatively insensible to pain. The introduction of the exploratory needle causes really no more pain at most than a hypodermatic injection. Danger has been incurred by the use of soiled sounds. Gall stones are, however, sometimes so soft as to escape detection in this way, and carcinoma may be so hard as to nearly simulate a gall stone. It must not be forgotten that gall stone and carcinoma not infrequently coincide in the same subject. Long-continued occlusion with persistent jaundice, marasmus, etc., in an individual in advanced life, speaks stronger for cancer than gall stone.

Lead colic—*saturnism*—has a history of exposure, also of repeated attack, without icterus, may show the lead line on the gums, or be associated with the arthritis, palsies, wrist-drop, or encephalopathies of this affection. Kidney stone—*nephrolithiasis*—is marked by pain lower, in the course of the ureters, by alteration in the urine, hæmaturia, etc.

The *prognosis* should be made with caution. Gall stones are often innocent. They reveal themselves at times only by accident. They may, however, at any time give rise to a train of symptoms of extreme severity, and they not infrequently cause death. The prognosis is by no means so grave as it was a quarter of a century ago. Surgery scores triumphs in the exsection of gall stones.

The *treatment* resolves itself into the treatment of attack and

the treatment of the interval—that is, the relief of pain, assistance to the discharge, and address to the conditions which lead to the formation of the stone. A light attack may be relieved by the external application of heat. Flannel garments wrung out of boiling water and applied over the whole abdomen and sides, covered in with thick, dry cloths, furnish the body the sedative and relaxing influence of heat and moisture. This effect may be increased by the ingestion of quantities of hot water. Contact with the seat of disease is closer in this way. Where practicable it is advisable to put the patient in a hot bath, full length. Resort must be usually had to morphia, preferably subcutaneously, gr. $\frac{1}{4}$–$\frac{1}{3}$, a dose which must be repeated as often as necessary. Great caution must be observed that the patient be not left inundated with morphia after the sudden relief of pain which follows the discharge of the stone into the intestine or its return to the gall bladder. Patients have been narcotized in this way. Pain, when present, neutralizes the effect of opium. The virtue of opium may be heightened by the addition of a small quantity of atropia, gr. $\frac{1}{120}$–$\frac{1}{60}$ at a dose. The atropia may not be repeated as often as morphia. Relaxing effects are better obtained by chloral. It is customary to administer with the subcutaneous injection of morphia a dose of chloral, g. x.–xx. internally. Chloroform itself, gtt. xv. or xx., may be taken in repeated doses in this way. It is not so good as chloral. Even these agents fail in bad cases. Resort must then be had to the inhalation of chloroform or ether, with the same precaution as is always observed in the administration of chloroform for the relief of pain elsewhere. It is here not a question of profound anæsthesia, as in the case of the capital operations of surgery. The object is to secure rather the relief than the abolition of pain or, at least, of consciousness. Chloroform may thus have to be given off and on for several hours or for several days. The administration of anæsthetics as antispasmodics is good practice in the treatment of gall-stone colic.

The real treatment of the condition is address, as far as possible, to its cause. This address is made first by regulation of the diet and habits of the individual. Fatty and highly seasoned foods, spices, sweets, dry or raw vegetables, cheese, heavy diet, must be eschewed. Patients should live largely upon fresh-cooked vegetable food; meat but once a day, lean meat at that. Fluids should be taken in abundance—soups, milk, especially water; mineral waters, especially alkaline mineral waters. The virtue of medicated waters is largely due to the water itself. It has been shown that alkalies in small doses have no effect upon the output of the bile, and in large doses hinder it. There is acknowledged virtue, however, in the increased alkalescence of the blood and the inundation of the bile ducts with

fluid. Gall stones whose very existence has remained unsuspected have been discharged during, at, or after a sojourn at a watering place, and free libation of alkaline mineral waters remains the best address to the cause. The Carlsbad water enjoys a deserved pre-eminence in this regard. Artificial Carlsbad salts, taken in the same way as the water—that is, freely, a glassful at a time, with intervening promenades—have the same effect. Gall stones may be dissolved very easily out of the body. They are soluble in ether, chloroform, or turpentine. From time to time patent, proprietary, and secret remedies have been proposed as solvents for gall stones. Durande's was a famous remedy for a time. It consisted of a mixture of sulphuric ether and turpentine. Whatever virtue it had was due wholly to the antispasmodic action of the ether—an action which may be much better obtained by the other means mentioned. Erosion, crumbling, disintegration of gall stones takes place naturally. It is supposed to be due to the action of micro-organisms. The discovery has not yet been made of any agent in chemistry which will bring about the same result. The salicylates undoubtedly make the bile flow. The best treatment of gall stones consists in the administration of Carlsbad salts in doses of a teaspoonful in a glass of hot water once, twice, thrice, or more during the day, with the continued administration of the salicylates in divided dosage; regulation of the diet of the individual, and change from a sedentary to an active life. It is a good thing to keep the gall stones which have been passed. Some idea may be had from their number and size, with what estimate may be made of the size of the gall bladder, as to the presence or absence of other stones.

ABSCESS OF THE LIVER.

Abscess of the liver ; suppurative hepatitis.—Abscess of the liver is a comparatively rare disease. Modern methods of investigation have shown, however, that it is more frequent than is commonly supposed. The statistics we possess come from the post-mortem table, and are consequently fallacious, in that most abscesses as well as most other diseases do not come to autopsy. Many unrecognized cases do not succumb at all. The most accurate records taken from the Berlin Pathological Institute disclose abscess in 1.5 per cent of autopsies. Abscess of the liver is, therefore, while not a frequent, by no means an uncommon disease. In no case is it perhaps more true that the life of the individual is more dependent upon the recognition of the disease. For abscess of the liver left alone usually terminates fatally.

History.—The lesion of the disease is so gross that it could not

escape the observation of the oldest anatomists. Hippocrates mentioned it and used the actual cautery in opening it. By the time of Celsus it had become a matter of dispute whether an abscess should be opened by fire or by the knife. The necessity of agglutinative inflammation previous to discharge was appreciated by the oldest savants. Morgagni, "De Hypochondrorum Tumore et Dolore," described the different directions of discharge of a liver abscess. Subsequent contributions to the history of the affection concern wholly its etiology. The aspirator introduced the new era in practice.

Etiology.—Abscess of the liver is no infrequent disease of the tropics, where it may be said to be indigenous. The statistics mentioned refer to the temperate zone, where the condition is the manifest result of some embolic or metastatic process. Liver abscesses as seen here are always multiple, the single abscess resulting from the coalescence of several or numerous smaller depots. The most numerous abscesses are found in connection with pyæmia, where the liver divides the honors with other organs. These abscesses are so numerous and so disseminated through the substance of the organ as to be unable to unite into one or a few collections. In these cases the disease has, as a rule, a rapidly fatal termination.

Abscess of the liver affects chiefly the period of adolescence and maturity. It is rare in infancy and extremely rare in advanced age. A curious fact in the history of abscess of the liver is the comparative exemption of the female sex. Females are affected in but four or five per cent of the cases. What makes this disproportion strange is the fact that dysentery, a disease in which the question of sex has no concern, plays such an important rôle in its production. The possible sources of infection of the liver are very numerous. Abscess may result as an extension by contiguity of structure: thus, in connection with suppurative affections of the gall ducts or vasa aberrantia; often in connection with intrahepatic gall stones; sometimes, much more rarely, from parasites, emigrated intestinal worms, distoma, etc. Foreign bodies which have penetrated from the stomach may be cited in this connection merely as curiosities. The most frequent cause of abscess of the liver in this way is the extension by erosion of a gastric ulcer after adhesion to the liver. All these cases are, however, extremely rare. As to *trauma*, it may be practically discarded as a cause of abscess of the liver. Frerichs reports a case of a laborer crushed between the buffers of railway carriages, with evident contusion of the liver and subsequent jaundice, but without any hepatitis; and Thierfelder cites a case of a soldier shot through the liver, with discharge of bile from the opening in the right side for a long time, and with complete recovery without suppuration. Any ordinary wound suppuration in the

course of injury to the liver would not fall under the head of an hepatic abscess.

The gateway to the liver is the portal vein, and the portal vein is the main avenue of metastases in the modern sense—to wit, embolic products. The portal vein includes a vast system of tributaries, in the domain of any one of which the original disease may lie. Thus, in the infant, disease products may come from the umbilical vein, in the adult from the gastric, splenic, pancreatic, and more especially from the mesenteric veins. Disease of any part of the intestinal tract may furnish morbid matter for the liver. The truth is, however, that but one disease assumes prominence in this regard, namely, dysentery. Abscess of the liver almost never arises in the course of typhoid fever, tuberculosis, or disease of the small intestine, but arises, as a rule, in the course of that severe or protracted ulceration of the large intestine clinically known as dysentery. The association was observed in the earliest times. Annesley thought that abscess of the liver caused the dysentery, that the abscess altered the bile in such a way as to make it irritate and inflame the intestine. Budd (1842) first announced the true relations of the diseases, showing that products were conveyed from the ulcers in the intestine to the substance of the liver. In two hundred and one cases of abscess of the liver tabulated by Waring, dysentery was found to have existed in three-fourths of the cases. The association is so frequent in the East that the pathologists there attribute both to the same cause. The relation first established by Budd is probably correct. Dysentery is by no means the exclusive, but is the most frequent, cause of abscess of the liver. Other diseases of the large intestine, typhlitis, proctitis, hæmorrhoids, fistulæ, or operations for the relief of these conditions, have been followed by abscess.

The pus-producing micro-organisms act as the direct causes of these abscesses of the liver. In certain cases the amœbæ found in dysentery (vide Frontispiece, Fig. 17) have been discovered in the pus of hepatic abscess, but whether as cause or mere coincidence is not yet known, as the exact rôle of these organisms in dysentery itself is not yet determined. The amœbæ may be shown in fresh fæces, but are best seen in mucus, pus, and blood. They are sometimes seen in the fæces in health.

Disease products may be conveyed to the liver also by the hepatic artery. Cohen found abscess in the liver after the injection of crude pus into the thoracic aorta. Putrid bronchitis, ulcerative endocarditis, suppurative processes about an aneurism, have been attended or followed by abscesses of the liver, presumed to have been conveyed through the hepatic artery. The older surgeons—Desault, Bichat—spoke of the frequency with which suppurative processes in

bone, more especially in the skull, were followed by hepatic abscess; and suppurative processes anywhere in the course of the systemic veins have been considered satisfactory explanation for abscess of the liver. It is well known of the veins of bone that they remain patulous under all circumstances and are unable to collapse upon their contents; hence the avenue of transit is kept open. More recent investigations, however, have shown that abscess of the liver is not more wont to supervene from infection of bone than from infection of soft parts. In all these cases the conveyance of infectious matter to the liver would have to take place through the lungs, whose capillaries are excessively fine. To explain away this obstacle it has been assumed that secondary emboli are given off from the thrombotic occlusions in the lungs. Unfortunately the metastatic products are found in the liver and not in the lungs, and metastatic abscess of the liver is much more frequent than the same process in the lungs. It is not necessary to appeal to speculation. Bacteria may pass through derivative vessels without the intervention of capillaries. Streptococci may pass a primary to lodge in a secondary set of vessels, especially in case of more sluggish circulation.

The last source of infection is by way of the hepatic vein, which, according to Meckel, is not very infrequent. The older physiologists —Magendie, Gaspard—found that mercury introduced into the jugular vein could be discovered in the liver. Cohen was not willing to accept this analogy for emboli. Heller experimented with particles of flour enveloped in Canada balsam and found the same results. He caused these light particles, against which the objection of weight could not be urged, to be sucked into the liver simply by the movements of artificial respiration, so that the theory of "refluent embolus" found support in direct experimentation. Heller also reported a case where a minute hepatic vein contained cancerous emboli which evidently originated from affected mediastinal glands.

Symptoms.—The symptomatology of abscess of the liver is rather indefinite. Reliable signs are very few. In certain cases the disease is *latent* and is revealed only upon autopsy, sometimes without the existence in life of any symptom of disease, oftener with symptoms, vague and indefinite, that have been referred to the stomach or have been diagnosticated under the elastic term *dyspepsia* or the very popular term *biliousness.*

Usually *the liver is swollen.* Abscess is most commonly found in the right lobe and toward the convexity, so that the enlargement in size is upward rather than downward. Dulness begins at the level of the fourth or fifth rather than at that of the seventh or eighth rib. Sometimes the enlargement is downward, sometimes the

weight of the liver causes a descent *en masse*. Occasionally the tumefaction may be felt, more rarely it extends to the level of the umbilicus or even to the crest of the ilium. There is often tenderness to pressure. Sometimes the *liver bulges* in the right hypochondrium, obliterating the intercostal spaces. The infection may redden the surface, or the abscess actually point between or under the ribs or at the epigastrium. *A surface œdema* sometimes indicates the best site for exploratory puncture. There is pain, as a rule; *a dull, heavy sense of weight*, as of a stick of wood, across the trunk —*sensation de barre*. More acute pain arises from perihepatitis. Pain at the point of the shoulder is often more significant. *Shoulder-tip pain—i.e.*, at the point of the shoulder—or pain in the blade or at the angle of the scapula, is, when present, a striking sign. It is more marked when the abscess occupies the convexity of the liver, and is absent, as a rule, when the seat is elsewhere. Luschka interpreted it first as due to the inosculation of the phrenic, whose filaments supply the suspensory ligament and convex surface of the liver, with the fourth cervical, whose filaments supply the shoulder. Twining called attention to the *rigidity of the right rectus* as indicative of abscess of the liver. The sign has some value, and is best estimated by comparative test—that is, by alternate palpation, with both hands, of the right and left rectus. The truth is, the rectus is rigid in any subjacent disease. The rigidity is an increased physiological tonicity and reflex irritation in protection of subjacent parts.

All or some of the signs of *dyspepsia* are found in connection with abscess of the liver. The tongue is heavily coated. There is *anorexia, vomiting, nausea, constipation*, and the general distress associated with these conditions. *Depression of spirits* assumes prominence in abscess of the liver. The terms *melancholia* and *hypochondriasis* indicate the connection which the older writers made between disease of the liver and depression of spirits. Hammond reported cases in which he was led to explore the liver several times, with successful results, on account of these symptoms alone. The mental state could have reference to disease of this kind only when it could not be accounted for in other and more obvious ways. Jaundice occurs as an exception, or, it might be said, as an accident, in the history of hepatitis suppurativa. An abscess might be so situated as, by its weight, to block the common duct. The disease may produce a *cachexia* along with marasmus, but not jaundice, which is found in but sixteen per cent of cases. Fever does not belong to abscess of the liver. *Chills and fever with sweats*, sometimes so periodic as to closely simulate malaria, *indicate pyœmia.*

The *diagnosis* rests upon the age and sex of the individual, particularly upon the history of previous disease—dysentery, etc. The disease may exist without reference to any of these conditions. The diagnosis then depends upon the tumefaction, the tenderness, protrusion of chest wall, and possible fluctuation ; the pain, especially the shoulder-tip pain ; the fever, the dyspeptic symptoms and depression of spirits. The diagnosis rests absolutely upon the discovery of pus by aspiration. Aspiration is practised in any doubtful case, with the needle of the aspirator, however, rather than that of the hypodermatic syringe, because the abscess is often deep and the pus is always thick. The point of election, unless indicated elsewhere, is somewhere in the neighborhood of the axillary line, behind rather than in front of the line, and above rather than below that diameter which might be called the equator of the chest. Where the first effort is a failure aspiration may be repeated at different points. The author failed once to find an abscess after penetration three times before a class of students and once later. On one occasion further penetration of the needle was stopped by a hard body. The patient subsequently died of peritonitis from perforation of an abscess, and upon post-mortem examination it was found that one insertion had penetrated to within one-twelfth of an inch of the abscess, where the needle was stopped by a dense pyogenic membrane. The puncture is usually painless. In the experience of the writer it became necessary upon one occasion to use morphia subcutaneously to relieve excruciating, lancinating pain, probably caused by injury to an intercostal nerve.

The abscess may discharge itself favorably. Most frequently it empties into the right lung after agglutinative inflammation with the diaphragm and pleura, and discharges itself through the bronchus, whereupon after the lapse of time the abscess refills to repeat its discharge. These are the so-called cases of phthisis hepatica. They are separated from tuberculosis by the *paroxysmal discharge of large quantities of pus after intervals of quiescence*, by the dulness tamquam femoris of the whole posterior portion of the lungs, as well as by the absence of the tubercle bacillus.

Of one hundred and seventy cases tabulated by Thierfelder seventy-four emptied into the bronchi, twelve into the intestine, twenty-six into the right pleura, twenty-three into the abdominal cavity, thirteen into the stomach, four into the pericardium, and one into the pelvis of the kidney. No consideration was made of openings upon the surface, as it was impossible to separate the cases of natural and artificial discharge.

The *prognosis* of hepatic abscess has entirely changed since the day of the discovery of aspiration. The disease had formerly the

appalling mortality of eighty per cent, due chiefly to perforation, pyæmia, and marasmus. Abscess of the liver has a constant tendency to rupture. It has no tendency to heal. Scars have been found in the liver as curiosities. Neither absorption nor favorable discharge can be counted upon. The sword of Damocles is suspended over the head of a patient affected with abscess of the liver. But recovery is absolute after evacuation of the abscess, even though there be left but a shell of liver tissue. The liver reproduces itself both by hypertrophy and hyperplasia. In rabbits, dogs, and cats a loss of three-fourths of the liver is completely restored in thirty-six days (Ponfick).

Treatment.—Drugs are of no value in the treatment of abscess of the liver. Indian and English physicians recommend ipecac as having the same virtue here as in dysentery. It is difficult to understand how this may be. Pain may require relief by heat and by morphia. The true treatment is the withdrawal of the pus and discharge of the abscess by aspiration or incision. Sometimes, rather exceptionally, a single aspiration suffices, or the operation may be repeated once or twice. It is safer not to wait too long, but to cut down at once upon the surface of the liver, unite it by suture to the abdominal wall, and plunge a knife—or better, to prevent bleeding, the blade of the thermo-cautery—into the abscess. In this way a vast internal abscess with its manifold dangers is converted virtually into an external ulcer whose surface may be subjected to actual inspection. The contents of the abscess are usually washed out and the cavity subjected to subsequent irrigation with drainage. A few weeks suffice, as a rule, to bring the case to a happy termination. Progress in the method of operating is shown by comparison of statistics. Curtis (1782) reports of the first operations a recovery of two of ten cases; De Castro, thirty-four of sixty-one; McConnel, twenty-two of thirty-four. In one case in the experience of the author pus reaccumulated after a second aspiration. Joseph Ransohoff, a surgical colleague, practised hepatotomy. The process of recovery at the end of the second week was interrupted by a return of fever, anorexia, general distress, when it was found that certain masses in the anfractious walls had become necrotic and remained attached. Under illumination with headlights and laryngoscopic mirror these masses were separated with forceps and the bleeding bases cauterized. This patient, a woman, finally made a perfect recovery. In the case of excessive pain after puncture, referred to, the first incision, which was superficial, discharged about one-half an ounce of pus; the patient was extremely emaciated and had suffered pain for six months. It was not believed that this quantity could account for his condition. A hypodermatic needle, plunged for two

inches below the bottom of this abscess, discovered an additional depot, from which was discharged over a pint of reddish hepatic pus. This patient also made a final recovery. It is safe to say that eighty per cent of cases are rescued by timely operation.

CIRRHOSIS OF THE LIVER.

Cirrhosis of the liver (*κιῤῥός*, tawny, orange-yellow); hobnail liver, contracted liver, gin-drinker's liver; interstitial hepatitis.—A disease of the liver chiefly caused by alcohol; marked by interstitial hyperplasia with subsequent contraction of the liver; characterized by dyspepsia, ascites, and marasmus.

History.—The oldest anatomists had their attention attracted to the small size and hardness of the liver in certain states of disease. Aretæus spoke of the hepar durum, and hepar scirrhus was another appellation to indicate hepatic induration. Bianchi even spoke of the "jecus in minimam molem retractum," and Vesalius of a case, attended with the well-known symptoms in life, where the liver on autopsy was found "totum candidum et multis trabeculis asperum," etc. Morgagni reported from his own observation, and from that of others, undoubted cases of cirrhosis in which the liver was found after death "totum granulosum."

This was, however, the sum and substance of knowledge of cirrhosis up to the time of Laennec (1819). The disease was not yet known as an affection distinct from others—from cancer, for instance—and nothing was known at all as yet either of amyloid or syphilitic change, or of the change produced by organic disease of the heart. So all these affections were confounded with cirrhosis. Laennec came upon the disease quite accidentally in the course of his examination of disease of the lungs. He had under observation a fatal case of pleurisy with hæmorrhage from the lungs, and he noticed at the autopsy the curious condition of the liver, which he describes in a few words. As this was the first recognition of the disease as a separate affection, the description is worthy of mention. He found the liver, he says, "reduced to one-third of its volume, concealed in the place it occupies, and seemingly composed of a multitude of grains of millet seed, of a yellow or yellowish-red color." In a footnote he adds: "This is a species of production which has been called scirrhus. I will designate it cirrhosis because of its color (*κιῤῥός*, tawny or orange color). Its development in the liver is one of the most common causes of ascites. The liver is always atrophied when it contains these cirrhoses." Laennec, therefore, regarded the "cirrhoses" as new formations, and in accord with this view Abercrombie described the yellow matter of cirrhosis as "in small nodules, like peas, dispersed through the substance of the liver." Abercrom-

bie says that the "French writers have a controversy whether the cirrhosis or yellow degeneration of the liver be a new formation, or a hypertrophia of the yellow substance which they suppose to constitute a part of the structure of the liver in its healthy state. No good can arise from such discussions," he adds naïvely, "as it is impossible to decide them." In the same year of the recognition of this the common form of cirrhosis (Laennec's cirrhosis the French still call it) Bouillaud showed that the nodular or granular appearance was due to atrophy of the red substance of the liver, whence resulted a more salient projection of the yellow substance. Kiernan (1836) first clearly pointed out the hyperplasia of the interstitial connective tissue which we now know to be the lesion of cirrhosis, and Gubler (1853) first called attention to the fact that the first stage of the disease may be characterized by hypertrophy, the second by atrophy of

FIG. 195.—Cirrhosis hepatis (hobnail liver).

the liver. Finally, Klebs (1868) first proclaimed phlebitis and periphlebitis of the radicles of the portal vein as the initial anatomical factor in the pathology of the disease. It is not the granules, therefore, which constitute the disease. The granules represent constrictions of the liver substance. The constricting agents, the connective tissue, constitute the disease, which is properly designated, as Bamberger has shown, "chronic interstitial hepatitis."

Etiology.—Almost from the very first recognition of the disease the cause of it was known. By all writers and clinicians cirrhosis is looked upon as an expression of chronic alcoholism. "Gin-drinker's" liver is its common name in England, and the extent of the use of alcohol determines the geography of the disease. Males are its most frequent victims, because, as Hyrtl remarks, "drinking is one of the male accomplishments." But typical cases are encountered among females under the same conditions. Even the apparent exceptions

support the rule (Niemeyer). "Thus Wunderlich found typical cases of the disease in two sisters aged eleven and twelve years; and on careful inquiry it was learned that both of them were great schnapps drinkers."

The liver has singular affinity for alcohol in any form. Percy found that he could recover alcohol in the bodies of dogs poisoned with it, from the blood, the brain, and other organs, but in greatest quantity from the liver. The researches of Perrin, Lallemand, and Duroy have shown that if we represent by 1 the quantity of alcohol found in the blood after the ingestion of a certain amount of it, that found in the brain will be represented by 1.34 and that in the liver by 1.38. This accumulation of alcohol in the liver, taken in connection with the sluggishness of the circulation of the liver, the hepatic radicles being the second set of capillaries, furnishes sufficient explanation of the selection of the liver as the organ which shall suffer most from the toxic effects of alcohol. Inasmuch, however, as all drinkers do not suffer alike, we must invoke, in addition to the alcoholism, some special susceptibility which renders the individual liable to cirrhosis. In this respect cirrhosis does not differ from nearly all affections. The continuous reception and escape of alcohol in the organs of secretion finally induce in them at first irritative and then inflammatory change.

First in order is chronic catarrh of the digestive tract, then degeneration of the glandular organs, atheroma of the vessels, pachymeningitis, forms of Bright's disease, and, among the later phenomena, cirrhosis of the liver. Thus epithelial cells and lining cells of vessels perish under long-continued irritation of alcohol, but the connective tissues before they perish are stimulated, under irritation, to excessive growth. Alcohol reaches the liver through the radicles of the portal vein. These radicles at their ultimate termination are among the finest and thinnest, as well as among the richest, systems of vessels in the body. The unoxidized alcohol—that is, that which is in excess of consumption—passes by easy osmosis through their delicate walls and bathes the equally delicate fibres and threads of connective tissue which form the soft skeleton work of the recesses of the liver. The nuclei multiply, the threads become cords and bands. When the connective tissue has attained its full maturity it begins to shrink. The liver is so shrunken by the retractile threads of connective tissue as to look, both upon its free surface and upon the surface of section everywhere, like the bottom of an ironfounder's shoe. "Hobnail liver" it is sometimes called, and the hobs or nodules may be sometimes felt in thin people or after tapping beneath the skin of the abdomen. It is not infrequent to find the whole of the left lobe shrivelled to a mere appendage to the right.

Alcohol does not, however, account for all the cases of cirrhosis. The connection between alcoholism and cirrhosis is so close as to justify incredulity concerning any other cause, and alcoholism must be eliminated before the idea of any other cause can be entertained. Virchow declared that interstitial inflammation may arise in the course of *syphilis*, and Frerichs cited a number of cases followed by cirrhosis. The syphilitic hepatitis distinguishes itself, as a rule, by its irregular development. The process is not so uniformly diffused through the substance of the liver as in a true cirrhosis. It is more apt to be accompanied by opacities of the surface and gummatous masses, and is found in association with evidence of the disease elsewhere. Much interest attaches to the question if intermittent fever, *malaria*, may be considered a cause of the disease. Cantani, of Naples, ascribes to malaria a potent influence in its production. The habits of life at this seaport town by no means exclude the possibility of the more common cause. Cirrhosis does not especially prevail in malarial climates. The disease should be more common in Africa, South America, and in the more intensely malarious regions of our own country, if due to this cause. There is no testimony to this effect. Botkin declared that he found cirrhosis frequently in connection with cholera and typhus fever, but this statement also lacks support. Gintrac and Ore found that they could produce cirrhosis in dogs by closing the hepatic vein ; and Solowieff observed that when the vena porta was ligated slowly and gradually the change in the circulation excited an interstitial process in the liver that could not be distinguished from that of true cirrhosis.

The conclusions from these experiments leave at least a loophole for the evasion of alcohol as a universal cause, in that possibly some other irritant may act like alcohol in producing the characteristic changes in and about the walls of the finer vessels.

The *symptoms* of cirrhosis irradiate from the liver as the central point. Most of them are easy of explanation on mere mechanical grounds. A few of the last and worst of them call out a knowledge of the physiology of the liver.

It may never be known just when the cirrhotic process begins in the liver, for the first symptoms are purely gastric. *Gastric catarrh* with its well-known attendants precedes the more pronounced and peculiar phenomena of the disease for months, or even years. *Gastric distress, nausea and vomiting*, especially in the morning, *heartburn, constipation alternating with diarrhœa*, compose the train of symptoms that march in the front or by the side of cirrhosis of the liver, for months and years at times, before the symptoms of more complete obstruction arrive. Gradually, however, the hyperplasia of the connective tissue advances, or gradually it tightens up

in its contraction upon intervening liver cells and vessels and ducts. *The skin grows sallow and dry, the conjunctivæ are yellow* from the start, *emaciation sets in*, all from lack of formation, or from slight reabsorption of blocked-up bile ; then water is forced out of the radicles of the portal vein into the abdominal cavity, *ascites* develops, and from the distended vessels blood may escape into the stomach or intestine. Collateral circulation may to some extent compensate for the occlusion of the portal vein, and thus obviate for a time the worst phases of mechanical hindrance. In fact, it is the establishment of collateral circulation that chiefly protracts the life of the individual affected with the disease. It is a matter of real surprise how many avenues of collateral circulation are brought into play in atrophy of the liver. There are vessels in the gastro-hepatic omentum from the lesser curvature of the stomach, and in the connective tissue between the folds of the omentum there are twelve to fifteen small vessels which pass from the gall bladder ; besides these, the vasa vasorum, the vessels which run along the walls of the portal vein, hepatic artery, and bile ducts ; a fourth group descend from the diaphragm in the suspensory ligament ; a fifth, the largest of all, the vessels which form the visible network on the surface of the abdomen communicating with the epigastric and internal mammary veins ; a sixth, the vessels which ramify upon the œsophagus and empty into the diaphragmatic veins. Fatal *hæmorrhage* has been reported by Audibert and Fauvel from œsophageal varices formed in this way. Thiebaudet reported a case running a latent course up to a fatal hæmorrhage, the cause of which on autopsy was found to have come from œsophageal veins. Litten found a plexus of dilated veins at the lower end of the œsophagus seven times. He attributes dilatation of these vessels to the overfilling of the azygos into which they empty. Gratia declares that the sclerosis extends throughout the whole portal system and helps to cause the ascites. Reitmann collected twenty-four cases of severe or a fatal hæmorrhage into the gastro-intestinal canal. One of these cases had been diagnosticated "ulcer of the stomach," a mistake corrected only upon autopsy. De-Bove and Courtois-Suffit also report a case considered gastric ulcer. The author had a similar experience. A man of middle age was suddenly prostrated by hæmorrhage of the stomach, upon the street, and was brought into the hospital exsanguine and unconscious. There was continuous discharge in large quantity of fluid black blood from the mouth. The hæmorrhage resisted all means of relief, and the patient died within twenty-four hours, without a history, and without a diagnosis other than the assumption of a possible gastric ulcer. Autopsy disclosed no lesion of the stomach, but a typical cirrhosis with the peculiar and exceptional condition of an enlarged

left lobe. It was subsequently ascertained that this individual had been a heavy drinker and had suffered from repeated attacks of hæmatemesis. *Next to ulcer of the stomach, cirrhosis of the liver is the most frequent cause of copious vomiting of blood.* Rollett reported a case in which hæmorrhage repeated itself at intervals of from four to five weeks for a period of two years.

Rokitansky first called attention to the circle of *tortuous and distended vessels about the umbilicus*, representing the so-called "caput Medusæ," present in cases of cirrhosis rather as an exception than as a rule. After much discussion concerning these vessels the appearance is now admitted to be due to the reopened umbilical vein (Bamberger, Baumgartner, and Klebs). These various avenues of collateral circulation may become enlarged to such a degree as to relieve the pressure in the portal vein and thus allow to disappear the ascites already formed, or, if preternaturally of large size, to prevent its appearance altogether. It is only in this way that we may account for the fact that a certain percentage of cases, according to Frerichs one-third of the whole number, shows no ascites at all.

Digestive disturbance, partly the direct effect of alcohol, partly the effect of arrest of the hepatic function; emaciation, and corresponding reduction of strength from the same cause; ascites; *enlargement of the spleen;* hæmorrhoids, and hæmorrhages from mechanical occlusions; enlargement and subsequent contraction of the liver itself—these are the chief and prominent symptoms of cirrhosis.

Jaundice is seldom marked. Some slight discoloration of the skin belongs to every case, but genuine icterus betokens rather an accidental complication (gall stone, compression by a band of hyperplastic tissue, catarrh of the bile ducts, etc.). Icterus is exceptional in cirrhosis, for the simple reason that the destruction of the liver cells prevents the formation of bile.

General dropsy or œdema of the lower extremities does not belong to the symptomatology of cirrhosis. A great accumulation of ascites may compress the vena cava, or a profound debility, the general result of the suppression or annihilation of the function of the liver, may cause general dropsy; but these factors are not peculiar to cirrhosis. So accumulations of fluid in the abdomen, or the heavy weight of the liver, may interfere with the action of the diaphragm and thus induce dyspnœa; but symptoms on the part of the respiratory system do not constitute an integral part of the history of the disease.

The brain is clear in cirrhosis throughout the course of the disease, but toward its close, when atrophy of the liver cells has become more or less complete, there supervene at times grave symptoms on the part of the nervous system—delirium, convulsions, or

coma—which indicate the toxic effects of elements that should be excreted with the bile. Pain, or even tenderness, is quite exceptional, and is due, when present, to perihepatitis. The shoulder-tip pain, which may be present in cirrhosis as well as in every other organic disease of the liver, is satisfactorily explained by the anatomical demonstration by Luschka of the anastomosis of the phrenic and fourth cervical nerves.

The *urine* in cirrhosis furnishes most valuable evidence. It is *scanty, dark, and turbid*, loaded with urates and other products of combustion, the result of the widespread havoc in nutrition. A clear and limpid urine would speak strongly against the existence of the cirrhotic process. It is now well known that the liver is the chief organ in the body in the manufacture of urea, but it is not necessary to appeal to this fact, when the waste is so universal, to account, in cirrhosis, for the accumulation of the urates (undecomposed urea) in the urine.

Lépine called attention to the glycogenic function of the liver in connection with cirrhosis. The liver makes and uses up sugar in greater abundance than any other organ in the body. Lépine found that sugar appeared in the urine of cirrhotic patients who had been fed with it—a result that might have been inferred from the destruction of the liver cells. In cancer this is not the case, because cancer is mostly localized in the liver and does not cause such universal abolition of function.

It is impossible to fix the *duration* of cirrhosis ; first, because it can never be known exactly when it commences ; secondly, because the course of the disease may be interrupted fatally (by a hæmorrhage, or as the result of pressure of ascites upon the heart and lungs, etc.), or conservatively by arrest of the process in the first stage or in the beginning of the second. While it is safe to say that the prognosis is bad, it is dangerous to proclaim that the patient must die soon, or must die at all of the disease. Cases are now abundantly on record, and they may be recalled in the experience of every clinician, where the disease process has been brought to a stand and the patient has survived for years.

Diagnosis.—The diagnosis of cirrhosis of the liver in the presence of ascites, shrinkage, and patent vessels upon the surface of the abdomen, even without the history, is an easy matter. Most importance attaches to the ascites, which means always obstruction to the portal circulation, as the most frequent cause of this obstruction is cirrhosis of the liver. Obstruction in the course of the portal vein itself—pyelophlebitis—is much more rare and the resulting ascites much more rapid. In the first stage of cirrhosis of the liver, or in the hypertrophic form, the organ is distinctly enlarged. It may

extend to the level of the umbilicus or even to that of the crest of the ilium. Usually, however, the process of enlargement is more limited. The edge of the liver may be felt an inch or two below the level of the ribs. It is also usually tender to pressure. Sometimes, rarely, the nodules may be recognized by touch. Any slight diminution in size easily escapes recognition, especially in the presence of much abdominal fat. Under all circumstances the liver usually preserves its upper line of dulness, as it is pushed up or held in place by the colon distended with gas. Much value attaches also to the condition of the *spleen, which is enlarged in three-fourths of cases.* The spleen is a reservoir into which is dammed back the blood which may not escape into the liver. Gastric and intestinal catarrh, constipation, tympanites, hæmorrhoids, and hæmorrhages have been sufficiently remarked. The hæmatemesis of cirrhosis is sudden, unpreceded by nausea, and unattended with pain—points which help to distinguish it from that of gastric ulcer.

During the stage or form of enlargement the disease must be differentiated from fatty liver, the icterus liver, amyloid liver, the leukæmic liver, and that peculiar hyperplasia which is known as hypertrophic cirrhosis, or elephantiasis of the liver. *Fatty liver is softer* and *amyloid liver is harder* than cirrhosis in the first stage. Both these degenerations may be usually ruled out by absence of their etiological conditions—syphilis, tuberculosis, suppuration of bones and joints. The *distention due to obstruction of the bile ducts* is excluded by the absence of any marked jaundice, and *leukæmia* is ruled out by an examination of the blood corpuscles.

Elephantiasis of the liver—*hypertrophic cirrhosis*—is attended with a pronounced jaundice from the start. In this condition there is no stasis of the portal vein and no ascites. Hypertrophic distinguishes itself from atrophic cirrhosis by the fact that the connective tissue swells, but does not subsequently contract; hence there is no compression of the radicles of the portal vein, no hyperæmia in the course of the portal tract, no *hæmorrhoids, and no ascites.* On the other hand, *jaundice is pronounced* and is almost universally present. *Nevertheless the stools are frequently colored with bile.* The presence of jaundice under these conditions is explained by primary inflammation of the gall ducts. There is in this form of the disease great tendency to nose-bleed, frequent pulse, and frequent cholæmia (Ewald). *The liver may be very much enlarged.* The surface is usually smooth. *The spleen is swollen.* The absence of the history of alcoholism in more than half the cases, the enlargement of the liver and spleen, the presence of jaundice with colored stools, and the absence of ascites, sufficiently distinguish this affection.

Fluxionary hyperæmias cause no obstacle to the circulation and no ascites. The change which takes place in the course of *heart disease*, the venous stasis which constitutes the so-called nutmeg liver, is attended with shrinkage in volume, from which true cirrhosis must be distinguished. It is enough here to recall the fact that the cardiac cirrhosis, so-called, must show the evidence of cardiac disease in the state of the heart itself and the evidence of disturbance of the circulation. In cardiac cirrhosis, also, anasarca precedes the ascites. It will be remembered always that enlargement of the liver due to cirrhosis is very rare.

Syphilis rarely shrinks the liver to the same degree ; it rather subdivides it into additional lobes and lobules, not into granules as in the course of true cirrhosis. Leube declares that syphilitic hepatitis is attended with more pain.

Simple atrophy is found in connection with the *marasmus* of wasting disease, more especially of old age. The liver maintains in this condition a smooth surface and edge, shows no granulation, no form of icterus, and no sign of block in the portal tract.

The fluid of ascites must be at times distinguished from that of an *ovarian cyst*. A low specific gravity, under 1015, speaks always for ascites.

Pyelophlebitis and pyelothrombosis are distinguished by the rapid development of ascites and other evidence of portal obstruction, enlargement of the spleen, hæmatemesis, venous ectasiæ on the surface of the abdomen. The discovery of a cause for the condition —some ulcerative process in the course of the portal vein or its tributaries, gall stones, etc.—lends further aid. The discharge of a murky fluid by aspiration or through the trocar, as evidence of chronic peritonitis, speaks in favor of affection of the portal vein.

The *indicatio causalis* in the *treatment* of cirrhosis is total abstention from alcohol. The time may come when the patient will need some support, and when the light Rhine wines, or even a little beer, may be allowed ; but any stronger drink must stand absolutely under ban. The diet should be light and nutritious, on a basis of milk and other animal food. A few drops of Fowler's solution after meals will help digestion, absorption, and more especially assimilation.

As for drugs in general, they may meet the symptoms only. With any knowledge of the anatomy of the disease, one may not hope to cure it. A stomachic tonic, nux vomica gtt. x.–xx. in a wineglass of water, or dilute hydrochloric acid gtt. x.–xx., or the tincture of the chloride of iron in the same dose, likewise diluted, may be written *ut aliquid faciat* and as real aids to digestion.

In hæmatemesis or enterorrhagia the treatment should be the

very opposite of that employed in gastric ulcer; thus, instead of ergotin to contract vessels, remedies should be used to dilate the arteries and diminish the pressure in the veins. On account of its almost immediate action in this regard, the amyl nitrite is especially indicated. More prolonged effects may be secured with nitroglycerin or other less powerful nitrites.

The only remedial agent that merits the name is puncture of the abdominal wall and release from the abdominal dropsy. Early and frequent puncture is the result of the testimony of those who have had most to do with cirrhosis. Murchison, especially, is emphatic in its praise. To wait until life is endangered on the part of the heart and lungs and kidneys is to let slip the only chance of arresting the disease. The release of the dropsy sets all the absorbents free. The peritoneum cannot pick up fluids under great pressure. Moreover, and this is the main advantage, the relief of the pressure renders possible the establishment of the collateral circulation—a process to be favored in every way. The removal of the cause of the disease by abstention from alcohol, and the removal of its worst effect by relief of the dropsy, give the patient the most scientific benefit. Purgatives (like the salines, Carlsbad salts), diaphoretics (like jaborandi), diuretics (like digitalis), tonics (like iron), may all meet indications at times in the earlier history of the disease; but *paracentesis* will substitute all of them when ascites is fully declared. Not only are the lungs relieved in this way, but, by the removal of pressure from the portal and renal veins, the secretion of urine is increased. "I have known hæmorrhage from the bowels," Murchison relates, "arrested by paracentesis in cirrhosis; and it is a common observation that patients with much ascites, who, notwithstanding the most powerful diuretics, have been passing only a small quantity of urine containing much albumin, will, after paracentesis, and independently of drugs, void large quantities of urine free from albumin." The same author quotes the experience of Lyons, of Dublin, in a case which he tapped thirty-six times at intervals of three or four weeks, withdrawing fourteen to sixteen quarts on each occasion, with the effect of bringing the disease to a stand at the end of one year after the last operation.

Thus it may be hoped to hold the disease in check, so far as the mechanical evils are concerned. Unfortunately, over the physiological evils there is less control. The body must have bile. A successful biliary fistula which carries off all the bile inevitably leads to the death of the animal by inanition. Should the interstitial process continue, which it does in the rule, the liver cells are finally killed, bile is no longer formed, and death by starvation results. This is the mode of death in most cases of cirrhosis, and death in

this way is *lege artis*. But the liver is immense in its size, it has superfluous cells in abundance, it has also remarkable regenerative powers, and the disease process may be arrested before destruction becomes universal.

HYPERTROPHIC CIRRHOSIS.

Hypertrophic cirrhosis; biliary cirrhosis.—Diseases of the liver are usually divided into those which shrink and those which increase the size of the organ. Cirrhosis, simple and acute atrophy, are the affections which shrink the liver. More numerous are the diseases which cause its enlargement. In this regard must be considered simple hypertrophy, hyperæmia, cancer, amyloid and fatty degeneration, echinococcus, and syphilis. Hypertrophy of the liver—the so-called hypertrophic cirrhosis, or hepatic elephantiasis—is a disease of most modern recognition. The practical value of its separation depends upon the fact that it has hitherto been regarded as the first stage of true cirrhosis. It is very questionable if true cirrhosis be ever attended with a preliminary stage of enlargement. It is probable that the disease begins with atrophy. Hypertrophic cirrhosis—the so-called hyperplasia of the liver—differs radically from true cirrhosis in the fact that, while the disease affects chiefly the connective tissue, this tissue does not shrink as in the true cirrhosis, and hence is not followed by symptoms of obstruction—hyperæmia of the stomach and intestine, hæmorrhoids, hæmorrhage, and ascites. On the other hand, enlargement of the spleen from the same cause is universally present, as is also icterus of high degree. Icterus is always present—a point of especial difference between this disease and true cirrhosis. Rosenstein, who met with this affection frequently in Holland, has come to the conclusion that it is a disease *sui generis* and that it never represents the first stage of atrophic cirrhosis. Hypertrophic cirrhosis occurs exclusively between the ages of twenty and forty, while atrophic cirrhosis occurs after forty. Alcoholism, the most frequent cause of atrophic cirrhosis, does not so often produce the hypertrophic form. Malaria with enlargement of the spleen plays a more distinct rôle in its production. The absence

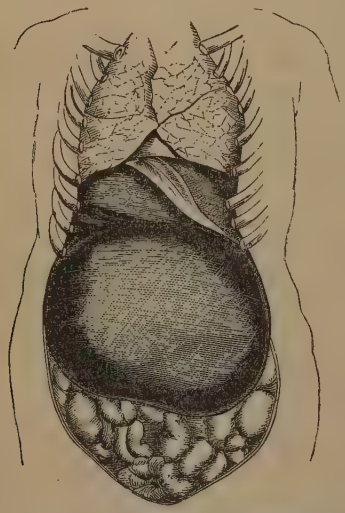


Fig. 196.—Apparent enlargement of the liver, the result of tight lacing (Murchison).

of icterus in atrophic cirrhosis depends upon degeneration of the liver cells. In hypertrophic cirrhosis, instead of acholia there is polycholia to such degree that the gall ducts are not able to carry it off, hence the jaundice. The association of icterus *with stools colored by the excess of bile* distinguishes this disease. The enlargement of the liver is usually marked, its consistence moderately hard, its border lightly rounded, its surface smooth.

Enlargement must not be mistaken for simple downward depression, as by effusion in the right pleura, subphrenic abscess, tight lacing, etc.

Hypertrophic is related to atrophic cirrhosis as is the large white kidney to the contracted kidney. Though the diseases are independent, the same transition forms may be observed. It is highly probable that the cases of atrophic cirrhosis characterized by enlargement in the first stage are really cases of hypertrophic cirrhosis. The disease lasts from a month to three years. Death usually occurs with the nervous symptoms of cholæmia.

The treatment is wholly symptomatic and does not differ from that of the atrophic form.

SIMPLE ATROPHY OF THE LIVER.

Simple atrophy of the liver is not a disease, but is part process of the general shrinkage which occurs in age and marasmus. Consequently, while the dimensions of the liver are markedly reduced in every direction, the symptoms of disease of the liver—pain, jaundice, hæmorrhage, ascites, etc.—are entirely lacking. These points make simple and easy a separation of this condition from cirrhosis.

ACUTE ATROPHY OF THE LIVER.

Acute atrophy constitutes the gravest, but fortunately the rarest, of the diseases of the liver. It is, indeed, amongst the rarest of all diseases. Many practitioners of large experience have never seen a case, and not more than one case is seen in a large hospital in the course of three or four years. As indicative of the rarity of the disease, even under favoring conditions, it may be said that Spaeth saw it but twice in thirty-three thousand cases, and Braun but once in twenty-eight thousand cases of childbirth. The majority of cases occur from adolescence to maturity, and in females nearly twice as often as in males, usually in them in the last half of gravidity.

Acute atrophy has been observed to follow cirrhosis of the liver, sometimes as a sequel to an acute infection (puerperal fever, typhoid fever, etc.), and is always seen to occur in the last stages of acute

poisoning by phosphorus. These conditions account, however, for but exceptional cases of a most exceptional disease.

The cause of the disease is unknown. It must be something in the nature of a virulent chemical poison, the product, probably, of some micro-organism, to produce such rapid and profound disintegration of the substance of the liver.

Symptoms.—The disease begins with the symptoms of an *ordinary gastro-intestinal catarrh*, associated from the start with a light degree of *jaundice*. There is nothing ominous in the onset of the disease. It soon reveals itself, however, in its true character, sometimes after a lapse of but few days, sometimes a few weeks, with a train of unmistakable symptoms, especially on the part of the nervous system. These symptoms—*delirium and convulsions, sopor, stupor, coma*—belong to the history of *icterus gravis*, and distinguish themselves in this disease by the suddenness of their occurrence and rapidity of their progress. In connection with them occur also *hæmorrhages* free from the various mucosæ, or subcutaneous as in the more protracted forms of icterus gravis. In all cases the striking feature of the disease is the shrinkage of the liver. Percussion reveals dulness at times of but one or two inches. Sometimes, again, hepatic dulness may not be distinguished at all. Occurring in pregnancy, it produces miscarriage with subsequent metrorrhagia.

The disease is distinguished, again, by the absence of fever. Some elevation of temperature is commonly present in the inception during the stage of gastro-intestinal catarrh. After the shrinkage has commenced or may be recognized the temperature is normal, or even subnormal, another distinguishing feature. The *urine is reduced* in quantity. It contains, as a rule, *quantities of leucin and tyrosin*, together with constituents of bile. Tyrosin often discloses itself, after the evaporation of the urine, in the form of delicate needles, grouped in colorless bundles or globular masses tinged with bile. The *urea* is often diminished to mere traces. Casts are occasionally encountered.

The *duration* of the disease is very short. Death occurs in the course of two or three days, after the supervention of the signs of icterus gravis. The *prognosis* is fatal.

The *treatment* is wholly symptomatic. Lebert is said to have cured a case with benzoic acid and musk; Teissier, another with aconite. The absence of details in the description of these cases throws doubt upon the diagnosis. Yet Wiesing reports from the literature sixteen cases of recovery.

Weil's Disease.—Under this title is described as *sui generis* a grave, infectious icterus which begins suddenly with chill and high

fever, headache, pain in the loins, bones, and joints, soon followed by bronchitis, albuminuria, *icterus*, and tumor of the spleen. Among recent authorities Alfermann admits and Fränkel denies it a special place in nosology.

HYPERÆMIA.

The liver certainly changes its size within certain limits, according to its distention with blood or bile. The icterus liver is always large. Overfilling of the blood vessels may also precipitately *increase the size* of the liver. In stasis of the liver *icterus* may or may not be present, in correspondence with the pressure or lack of pressure upon the gall ducts. So, too, *ascites* may be present or absent, according to the degree of venous stasis. *Swelling of the spleen* is almost always present. The characteristic feature is the alteration in the size of the liver in correspondence with the increased or decreased tone of the heart. Hyperæmia of the liver indicates fault in the circulation. Usually there is some *obstruction in the heart*. Valvular disease of the heart, weakness of the heart muscle, heart failures, obstructions in the lungs, lead to insufficiency of the tricuspid valves and regurgitation into the liver. The stasis of the sublobular veins, with the altered nutrition of the hepatic cells, gives rise to that change of color, seen on section, which is characterized as the *nutmeg liver*.

Hyperæmia of the liver may, therefore, be diagnosticated only in the presence of some fault of the circulation, usually in connection with disease of the heart or lungs. The "congestion of the liver," so often remarked by the laity, has reference to distention by bile. This congestion, or "torpidity," as it is also called, is usually an expression of gastro-duodenal or biliary catarrh, and is in no sense a true congestion or hyperæmia. At the same time it must be recognized that the liver has certain definite antiseptic properties, interference with which leads to accumulation of toxic matter in the intestine. When a section of liver tissue is destroyed or a large artery tied, the animal dies in the first instance in eight to fourteen hours and in the second in four to eight hours. But if injected with an emulsion of liver substance it may be kept alive for several days (Masini). The dulness and distress of "biliousness" may be thus a real expression of torpor or inactivity of the liver.

FATTY LIVER.

Fatty liver never reaches the excessive grades of enlargement of amyloid degeneration. In the most extensive case of fatty degeneration the liver does not reach below the umbilicus. Its surface is perfectly smooth, its consistence remarkably soft. Fatty liver occurs more especially in connection with tuberculosis, cancer, phosphorus

poisoning, where it meets its main expression. It is seen also in certain cases of obesity.

It is, as a rule, unattended with symptoms of disease of the liver—pain, jaundice, and ascites—and is of interest only from the point of view of differential diagnosis.

AMYLOID LIVER.

Amyloid liver is only a part process of a widespread degeneration. Amyloid degeneration is a peculiar retrograde change in the hepatic tissue. It is usually found in connection with amyloid degeneration of the kidney, of the spleen, often of the mucous membrane of the intestinal canal. The recognition of the affection depends, therefore, upon its association with lesion of other organs. It is found as the result of chronic suppurative processes, more particularly of bone caries and necrosis of bone, especially of protracted course, or suppurative processes of the skin, mucous membranes; sometimes in serous membranes. Empyema may precede for months the development of an amyloid change. Syphilis, cancer, malaria, leukæmia, Bright's disease, pyæmia, rheumatism, exhausting discharge, may develop this change.

In amyloid degeneration the liver reaches at times great *magnitude*. It may largely fill up the abdominal cavity. As a rule it reaches to the vicinity of the umbilicus. *The surface is perfectly smooth, the border round, and the consistence very hard.* In exceptional cases the enlargement may be but slight and the border sometimes remains sharp. There is no icterus and no ascites, save that which occurs in the last stages of the disease in connection with anasarca. The dropsy is confined to the lower extremities. The condition is recognized in the size of the liver in every direction, by its uniformly smooth surface, resistance, and by the absence of icterus and ascites.

The etiology of the affection—bone caries, tuberculosis, inveterate syphilis, chronic malaria, carcinoma—bespeaks the character of the disease. Attention is usually directed to the liver by the discovery in the urine of evidence of amyloid degeneration of the kidney.

CANCER OF THE LIVER.

Cancer of the liver is usually secondary. It is primary in but eighteen per cent of cases (Siegrist). In the vast majority of cases it occurs in the course of cancer of the stomach. Sometimes the cancer is quiescent in the stomach, while the secondary deposit in the liver assumes prominence and overshadows the primary lesion. Cancer of the stomach may be secondary also to cancer of the breast, uterus, rectum, or other organ. Thus a digital examination

of the rectum or vagina has often led to a true interpretation of the nature of a chronic or grave affection of the liver. Cancer of the liver is sometimes latent, and has been recognized upon the post-mortem table in the absence of signs in life. It betrays itself usually, however, with unmistakable signs. *The volume of the liver*, as determined by palpation and percussion, *is early increased, and soon reaches enormous dimensions.* It may extend from the angle of the scapula to the ileum. *The surface is hard, but not smooth; it is broken by protuberances and nodules. Icterus* is present in about half the cases, and depends in degree upon the site of the deposit. *Ascites* is present, but is not, as a

FIG. 197.—Cancer of the liver, *a*; with multiple metastases, *b*, *b*, *b*; within the liver (Ziegler).

rule, pronounced. The body of the liver may be usually felt through it under forcible, especially intermittent, palpation. The fluid may be clear, but it is usually *turbid or bloody.* Pain may be present or absent, and, when present, is rather an expression of a perihepatitis. The *stools* vary in color and consistence, according to the presence or absence of bile. In the later course of the disease they are often stained or *tinged with blood.*

As in cancer elsewhere, cachexia gradually develops. The disease advances rapidly in the liver, and usually takes life in the course of six months to a year.

Treatment is wholly palliative.

Echinococcus of the liver is discussed in connection with tapeworms.

DISEASES OF THE ORGANS OF RESPIRATION.

CHAPTER V.

DISEASES OF THE NOSE AND THROAT.

DISEASES OF THE NOSE.

Diseases of the organs of respiration begin with the affections of the nose. *Acute catarrh* of the nose is distinguished as coryza. It is often found in association with catarrh of the conjunctiva and of the throat, especially in connection with various infections, to the effluvia of which these mucous membranes are exposed. These surfaces constitute the avenues of invasion. Or the affection begins in

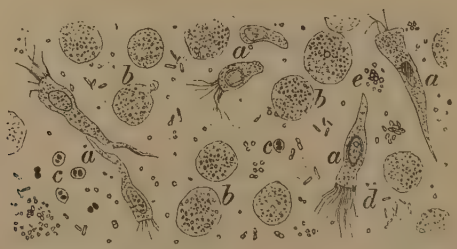


Fig. 198.—Nasal mucus: *a*, ciliated cells; *b*, leucocytes; *c*, capsule cocci; *d*, bacilli; *e*, micrococci.

the nose and extends through the throat to the bronchial tubes. More frequently the affection remains confined to the nose, to constitute an acute or chronic nasal catarrh.

Acute nasal catarrh is the evident expression of some outside irritant. But that the irritant may also come from within is proven by the effects of iodine, which, in toxic dose or in susceptible individuals, produces exquisite nasal catarrh. The disease announces itself by *dryness*, *burning*, and irritation, which produces more or less constant *sneezing*. Very soon the surface is moistened with a

discharge; watery mucus accumulates and escapes upon the face, requiring the constant use of a handkerchief. The mucous membrane swells, often to occlude the nares. The spongy structure of the mucous membrane permits rapid swelling, so that mere gravity, as in lying upon one side of the body, will block one side of the nose, and the block may be changed by changing posture. Fever, more or less *headache*, *hebetude*, soreness and *pain* in the frontal region which may be due to extension of inflammation to connecting sinuses, are further signs of an acute nasal catarrh.

Chronic catarrh of the nose is much more frequent. It results at times from repeated attacks of acute catarrh. It occurs most frequently in connection with scrofula (tuberculosis) and syphilis, where it leads to alteration of structure, hyperplasia and occlusion,

FIG. 199.

FIG. 200.

FIG. 199.—Adenoid tissue at vault of pharynx (Luschka).
FIG. 200.—Posterior nares in the rhinoscope: *a*, uvula; *b*, *b*, orifices of the Eustachian tubes.

or atrophic change. The process extends also to the posterior nares, and is liable to invade the Eustachian tubes; it is therefore a common cause of deafness. The secretion is altered; it becomes more or less profuse and offensive (ozæna); the true gland structure in the mucous membrane is destroyed. According to Schuchardt the ciliated epithelium is destroyed, and substituted by squamous cells, which much more readily suffer decomposition. Subsequently the bone substratum itself may be affected. Thus chronic catarrh is, as a rule, a specific process.

Syphilitic catarrh is especially wont to be attended with destructive change, ulcers, and necroses. Gummatous perichondritis breaks down the cartilage and bony structure, with the formation of exces-

sively offensive discharge, which dries to form crusts, under which the destructive change continues, to constitute the syphilitic ozæna.

Treatment.—Acute catarrh of the nose is a common expression of a "bad cold." It is usually of short duration, and is best relieved by quiet and rest in the house. Sometimes an attack may be cut short with a dose of Dover's powder gr. viij.–x., and hot baths and hot drinks to excite profuse diaphoresis. Of a solution of atropia, gr. i.–℥ i, three drops, repeated two or three times a day, will often quickly relieve the distress of acute catarrh. See also treatment of angina and of acute laryngitis.

Chronic catarrh of the nose is a malady of months', often years', duration. Successful therapy depends upon a recognition of its cause. Syphilis calls for the use of mercury, especially by inunction, and iodide of potassium, under which the most obstinate and destructive changes speedily yield; scrofula for tuberculin, cod-liver oil, creosote, and the iodide of iron. Free ventilation of rooms with pure, fresh air is in all cases a *sine qua non*. Local treatment is of great value. The nose must be kept clean with douches of salt water. Warm water, containing a drachm each of common salt and carbonate of soda to the pint, may be snuffed up the nose or introduced by means of a syringe, care being taken, by keeping the source low, to avoid penetration of the Eustachian tubes.

Ointments keep the mucous membrane soft and the fossæ open:

℞ Acidi borici.....gr. xv.
Unguenti petrolati.....℥ ss.

M. A mass the size of a bean or hazelnut to be snuffed up the nose morning and evening.

Or—

℞ Hydrargyri oxidi flavi .....gr. v.
Unguenti petrolati. .....℥ ss.

M. To be introduced the same way.

Fetid atrophic processes are best treated with iodoform, creolin, creosote, or that combination known as europhen, which is an iodide of creosote, hence less noxious in its effects, as well as to the sense of smell, than iodoform. The remedy is best introduced in the form of an ointment:

℞ Europhen.....gr. x.
Olei olivæ.....ʒ i.
Lanolini.....ʒ iij.
M.

Solutions of pyoktanin, 1 : 100, introduced with a saturated cotton-wrapped sound, purify all secretions and rapidly penetrate the

recesses of the nose. A very effective treatment of ozæna consists in the application of the creolin-ichthyol solution. The nose is first washed out with an alkaline solution and thoroughly cleansed with a cotton-wrapped sound. The ichthyol is applied in a five-per-cent solution of creolin. The bad odor rapidly disappears. Hypertrophic processes and occlusions are best removed by concentrated solutions of trichloracetic acid, which is also applied with cotton. The pain which occurs a few minutes after the application slowly subsides. It is not so easily subdued by previous applications of cocaine as with the use of the galvano-cautery. The mucous membrane is burned snow-white under this acid. The process of healing takes place without reaction or pain. The incrustation is desquamated quicker than after burning (Killian). Finally, the practitioner may have recourse to the use of the galvano-cautery. Batteries with suitable end apparatus are now furnished at very reasonable price.

Polypi (mucous) which may undergo cystic degeneration, adenomatous, telangiectatic, or fibroid growths, more exceptionally chondromata, steomata, sarcomata, occur in the nose or connecting cavities.

Polypi, etc., must be extracted by surgical means.

DISEASES OF THE LARYNX.

The progress of medicine is scarcely anywhere better exemplified than in the diseases of the larynx. Less than half a century ago the interior of the larynx was an undiscovered country. The physician was able to recognize laryngeal disease in general, but was in no way able to distinguish the character of the disease. The deepest recesses of the body were not more dark than the interior of the larynx.

History.—Bozzini (1804) made an attempt to illuminate the interior of the body, but, so far as the throat was concerned, the attempt reached the pharynx but not the larynx. Cagnard de Latour in 1825 actually introduced a mirror into the throat, but failed in reaching any conclusions for want of light. Two years later Babington invented a glottiscope with mirror and tongue depressor, and actually used reflected light, by means of which he claimed to have been able on several occasions to see the epiglottis, but nothing more. Selligues (1832), a victim of tuberculosis, made the attempt to inspect his own larynx, in the hope of being able to treat himself. He constructed a speculum out of a closed tube, and, as might have been imagined, saw nothing. Baumês introduced a mirror fastened to the end of a fish bone as a stem, and claimed to have seen by the aid of it ulceration in the larynx. Liston and Warden, with the use of mirrors and handles, declared that they were able to distinguish

œdema and swelling of the epiglottis. Thus far crude experiment with barren result. The real illumination was made by a singing teacher, the celebrated Manuel Garcia, who introduced a mirror deep in the throat, heated it in warm water to prevent the cloud of the breath which shut off all sight, and fixed his patient so that the sunlight fell directly upon the glass in the throat, and so by the adjustment of the mirror was able to study the interior of the larynx. Garcia studied the larynx from the standpoint of the vocalist. He watched the play of the vocal cords during phonation and respiration, and described the process in a monograph entitled "Physiological Observations on the Human Voice," communicated to the Royal Society in 1855. With the use of an outside mirror Garcia introduced auto-laryngoscopy. He studied the process in his own throat. Strange to say, this remarkable observation excited no interest or attention, and it was not until two years later that Türck, an assistant at the General Hospital in Vienna, made these observations anew. Türck also used sunlight, and hence was able to study the subject only in propitious weather. He did not realize the extent of his discovery. It was different with Czermak, who borrowed the mirror of Türck and developed laryngoscopy. Türck had already discovered the ease with which the throat might be inspected by withdrawal of the tongue. Czermak adopted this method. He was the first also to use artificial light, which enabled him to study the subject day and night. He became inspired with it. He was like a man who first saw the light after a long blindness. He travelled about to the different universities of Europe, gave directions in every direction, and practically established, or gave the incentive which resulted in the establishment of laryngological clinics everywhere (Fleischer). A few years later Bruns took a tumor out of the throat of his own brother; and in less than a decade a host of observers—Semeleder, Schrötter, Gerhardt, Ziemssen, Voltolini, Tobold, Levin, Fauvel, Mackenzie, B. Fränkel—described every process of disease. Artificial is now substituted in our day by the electric light, which gives natural colors and appearances; and these discoveries, with the invention of much apparatus, including the galvano-caustic storage battery with suitable electrodes, have, so to speak, turned the larynx inside out and rendered all its diseases, if not curable, recognizable and amenable to treatment.

FIG. 201.—Normal larynx and trachea to bifurcation of bronchi.

The diseases of the larynx which most commonly call for treat-

ment are acute and chronic catarrh—*i.e.*, acute and chronic laryngitis, including laryngismus stridulus (spasmodic croup), true croup, œdema, perichondritis, and paralysis. The general diseases which affect the larynx are tuberculosis, syphilis, and cancer. They are none of them confined to the larynx, with the exception, perhaps, of cancer, which is not infrequently primary in the throat.

Catarrhal Laryngitis is very frequent and is one of the expressions of a common cold. Just how catching cold produces laryngitis is as difficult to explain as is the process elsewhere. It is often assumed that hyperæmia liberates toxic matters from micro-organisms at other times latent or quiescent. It is known, for instance, of the tubercle bacillus, that it abounds in the lymph spaces and vessels of the larynx. These bacilli are derived in all cases through lymph tracts from the lungs. They almost never penetrate from the surface of the mucosæ. The subjects of tuberculosis are particularly prone to suffer laryngeal affections. The first stage of tuberculosis is a stage of catarrh, which differs in no way from catarrh from any other cause. There are individuals who suffer laryngitis with every exposure. They are for the most part individuals who lead indoor lives, in whom the mucous membrane is sensitive by long stay in over-heated and ill-ventilated apartments. Criers, public speakers, singers, preachers, auctioneers, are particularly prone to laryngitis. The laryngoscope reveals the condition. The mucous membrane is swollen, reddened, tumefied. The vocal cords, which should glisten white like dog's teeth, are tinged with red here and there, or are more or less uniformly red. The inside of the throat looks like a piece of red flannel. It is seen that the cords may not so closely approximate each other in phonation. The slightest swelling, or the slightest failure in muscular tonicity, or the slightest accumulation of mucus changes the character of the voice. The voice loses its individuality ; it becomes altered, hoarse, husky; the individual may make himself heard only by straining efforts. Finally the voice is lost altogether and the patient is reduced to whispers.

Acute catarrh distinguishes itself by hyperæmia, chronic catarrh by hypertrophy. In chronic catarrh the throat is not so red. The hue is more dusky, slate-colored in places. The membrane is thickened. The arytenoid cartilages are hindered in their free movements. The interarytenoid band is more thick. There is, however, no break of the surface, no such hyperplasia of tissue as to constitute a tumor, and, other than thickening of the mucous membrane, no deformity. Motion may be more sluggish, but there is no paralysis. Often there is a sensation of burning and dryness. There is frequent, harassing, rasping cough, with the extrusion of tough, glutinous mucus, which may be seen adhering to the vocal cords or

other parts of the interior of the larynx. There may be in an acute inflammation slight fever. In chronic catarrh the symptoms are less intense but more persistent. The voice remains husky ; it becomes susceptible to changes in the weather. Raw, damp weather aggravates chronic catarrh ; mild, dry, warm weather benefits it. Individuals secure exemption by spending the fall and winter in Florida, Lower California, or other warm climate.

The *treatment* demands above all things *rest*, and the difficulty of obtaining satisfactory result is due to the fact that the avocation of the individual requires more or less constant use of the voice. Singers must sing and preachers must preach. Many of the victims of chronic catarrh of the larynx have a mania to talk. In some of the worst of these cases the long-continued catarrhal process has actually brought about usury of the vocal cords. Irrepressible talkers affected with this disease have actually talked away parts of the vocal cords.

The general principle of treatment consists in the application of astringents. The best astringent is nitrate of silver, one- or two-per-cent solution, applied always with the cotton-wrapped sound under the laryngoscope. The plan in present use is to saturate quite a large mass of cotton in solution and apply it with the laryngeal forceps directly into the throat, if necessary after an application of a four-per-cent solution of cocaine, which is itself sometimes used alone in highly sensitive cases. Practitioners have preferences in the choice of astringents. Tannin has advocates, as has also ferric alum. Others prefer the more antiseptic preparations—carbolic acid, permanganate of potash, sublimate solutions, thymol, pyoktanin, aristol, dermatol, etc. In chronic catarrh with much hypertrophic change no remedy equals in value the galvano-cautery in light and momentary touch. Inhalations are of value, best by steam from the atomizer and medication with common salt, preferably with the bicarbonate of soda, saturated solution, or an astringent, as specified. Gargles assist in controlling an associate pharyngitis. They are of no value in laryngitis proper. Sponges should be abolished, as should also brushes. Applications should be made with fresh cotton by means of the laryngeal forceps.

Acute cases are often relieved by compresses, cloths saturated in water, hot or cold, applied about the throat and enveloped in thick, dry cloths. Broken doses of Dover's powder, or a round dose of Dover's powder, ten grains at night, with a hot bath and free diaphoresis, may cut short an acute case. A round dose of quinine with an ounce of whiskey may have the same effect. Treatment in general is that of a common cold. Chronic cases are especially defiant of treatment. They try the patience of the practitioner. They are

often associated with hypochondriasis. They furnish the basis for the specialist. They are often entirely relieved, as stated, only by change of climate.

ŒDEMA OF THE GLOTTIS is a much more serious affection. It occurs most frequently as the result of an outside cause, as from Bright's disease, disease of the lungs, emphysema, heart disease, etc. In only one-third of the cases does œdema arise from affection of the larynx proper, and then more frequently in the course of acute laryngitis. Œdema gives great gravity to an ordinary case of laryngitis, and, in association with œdema of the lungs, is often the terminal link in the chain of disease process. Œdema may extend above the larynx to involve the palate, and more especially the uvula, which sometimes has the appearance of a Malaga grape. The rim of the œdematous epiglottis may occasionally be seen on depressing the tongue. For the most part the condition must be felt, not seen. It may be recognized, by the finger introduced deep in the throat, as a soft, semi-fluctuating mass about the base of the epiglottis. It is necessary to recognize œdema early, that the fluid may be evacuated while it will flow. Scarification is the treatment, with a bistoury wrapped close to the end that it may not penetrate too deeply. Where incisions are not practised sufficiently early the fluid sets—*i.e.*, gelatinizes—and subsequent scarification will not evacuate it. Resort must then be had to intubation or tracheotomy.

FIG. 202. — Œdema of the glottis (Cohen).

PERICHONDRITIS depends upon the graver diseases, tuberculosis, syphilis, and cancer. It does sometimes occur, however, in the course of an excessively obstinate chronic catarrh. In the majority of cases it shows itself as a more acute complication in the course of septic diseases or the infections. Perichondritis may occur in consequence of variola, rubeola, more rarely scarlatina, still more rarely erysipelas. The cricoid cartilage is chiefly the seat of the disease. The thyroid is rarely involved, and the arytenoid only in the most exceptional case. It is recognized by the pain in the region of the larynx, more especially by the tenderness. Fluctuation, as detected by outside palpation, may reveal the presence of phlegmonous inflammation or abscess.

The *diagnosis* is usually disclosed by the laryngoscope, which shows at a glance more or less deformity.

The *prognosis* will depend upon the original disease, as well as upon the amount of deformity. It is always grave, because of the gravity of its cause. Immediate danger of stenosis may be obviated by incision, by dilatation, by intubation, by tracheotomy. The procedure will be determined in the individual case.

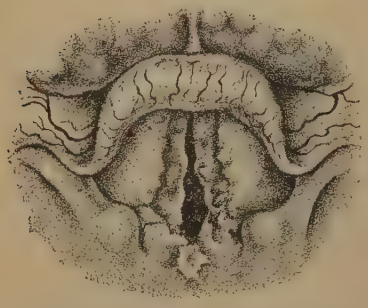


FIG. 203.—Advanced tuberculosis of the larynx.

Next to catarrhal laryngitis the most frequent affection is TUBERCULOSIS, caused, as stated, by the direct invasion of the submucous lymph spaces and vessels by the tubercle bacillus derived from the lungs. It produces at first only catarrhal changes, present at times and absent at times, but with more or less tendency to continual recurrence, later more pronounced hyperæmia, more limited localization of lesion, tumefaction, ulceration, eventual extreme deformity. Cough, dysphagia, and dyspnœa, along with

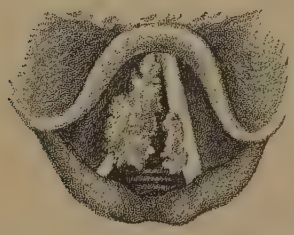


FIG. 204.—Papilloma of the larynx (Ingals).

FIG. 205.—Fibroid tumor of the larynx.

complete aphonia, distinguish these cases. The aphonia assumes prominence. It is sometimes the only symptom to indicate disease of the larynx, so far as outside symptoms go. The laryngoscope clears the diagnosis at a glance. Very often the inside of the larynx cannot be seen at all, but is hidden under an immensely swollen, tumefied, œdematous, sometimes ulcerated epiglottis. It is interesting to observe the gradual elevation of this overhanging epiglottis under applications of cocaine, and more especially under the use of tuberculin. The same changes are observed in the interior of the larynx, on the lips of the glottis, viz., tumefied cords, hyperæmic, œdematous, distorted bands, obliterated sinuses, various deformities.

FIG. 206. — Cancer of the larynx.

The *prognosis* is exceedingly grave. Laryngeal tuberculosis usu-

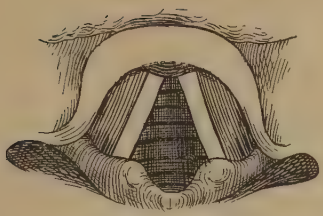


FIG. 207.—Normal larynx. Position of cords in deep inspiration.

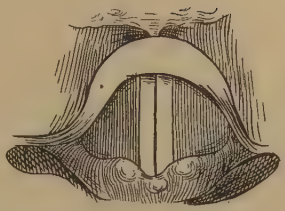


FIG. 208.—Normal larynx. Position of cords in phonation.

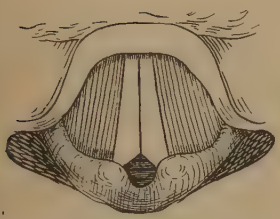


FIG. 209. — Paralysis of the arytenoid in phonation.

FIG. 210.—Paralysis of both thyro-arytenoids in phonation.

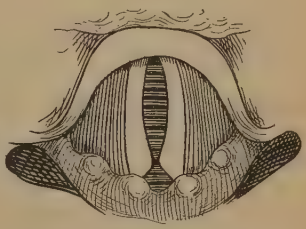


FIG. 211.—Paralysis of the arytenoid and both thyro-arytenoids in phonation.

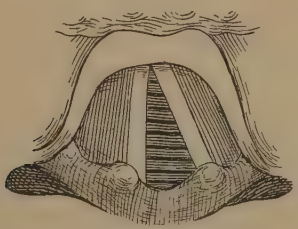


FIG. 212.—Paralysis of left recurrent in respiration.

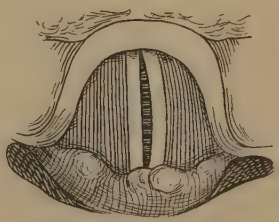


FIG. 213.—Paralysis of left recurrent in phonation.

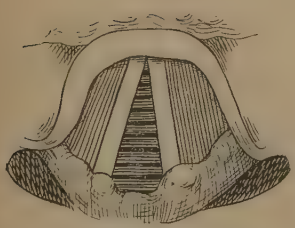


FIG. 214.—Paralysis of right posterior crico-arytenoid in respiration.

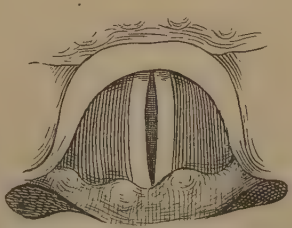


FIG. 215.—Paralysis of both posterior crico-arytenoids in respiration.

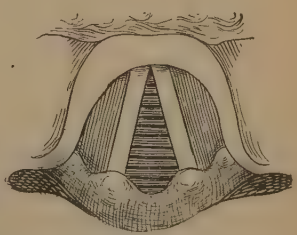


FIG. 216.—Paralysis of both recurrents—cadaver.

ally defies all kinds of treatment. A patient with marked laryngeal tuberculosis has without treatment, as a rule, at the outside not more than six months to live.

The *treatment* is that of tuberculosis in general, especially by tuberculin, creosote, arsenic, cod-liver oil, altitude, etc. Local treatment consists in the use of cocaine to allay extreme hyperæsthesia and dysphagia; the insufflation of iodoform; or, far better, the application, with a brush, of lactic acid solutions, twenty to eighty per cent. The last stages demand morphia by insufflation. Applications do not reach the larynx at all unless made under the mirror in a good light.

Curious lesions occur in the mucous membrane in consequence of typhoid fever. Ecchymoses, erosions of tissue, show themselves on the under surface of the epiglottis, and especially on the front wall of the larynx, produced by the typhoid bacillus, or more probably by bacteria of mixed infection.

Syphilis shows itself in the larynx at first as an ordinary catarrh; subsequently, with infiltration, hyperplasia, and ulceration, most frequently of the epiglottis, vocal cords, and posterior wall of the larynx. Extensive necroses may denude large masses of cartilage. Syphilis shows itself also in the form of gummatous deposit in the epiglottis and vocal cords, which may result in ulceration and destruction, perichondritis and necroses, with great deformity. The *diagnosis* rests upon the recognition of the disease elsewhere in the body, and upon the results of specific *treatment* by mercurial inunctions, the iodides, which should always be tried in questionable cases, that the patient may have the benefit of a doubt.

Paralysis of the Larynx occurs in connection with lesions of the brain and spinal cord (bulbar lesions), as the result of pressure upon nerve trunks, as of the left recurrent in aneurism of the aorta, and in consequence of accident to or disease of the larynx itself. These various paralyses are shown in the figures on page 487, taken from Wesener's work on diagnosis. Aphonia or dysphonia, sometimes dyspnœa and dysphagia, are the principal signs of these paralyses, which are treated generally by address to the cause, and locally by strychnia subcutaneously and electricity.

Tumors of the larynx, polypi, etc., which are easily visible under the laryngoscope, may be removed, under cocaine ten per cent, with the forceps, or may be destroyed by caustics, or, better, by the galvano-cautery. *Cancer*, which shows itself in more advanced life with pain, lymphadenitis, and deformity, justifies extensive exsection, with, if necessary, substitution by an artificial larynx.

CHAPTER VI.

DISEASES OF THE LUNGS.

BRONCHITIS.

INFLAMMATION, for the most part infection, of the bronchial tubes.

Bronchitis is the most frequent of all diseases. It constitutes three-tenths of all internal maladies. It affects all ages, with especial predilection for both ends of life. It increases in frequency from the equator toward the poles. It is recognized in forms acute and chronic, circumscribed and diffuse, ascending and descending, with varieties according to the character of the secretion and the condition of the bronchial walls; but the division which has chief interest is into primary and secondary, the so-called idiopathic and symptomatic forms.

Etiology.—It is easy to understand the origin of cases of primary bronchitis caused by the action of irritating or irrespirable gases or dusts. Individuals employed in factories for the production of ammonia, chlorine, iodine, bromine, or strong mineral acids show occasional attacks of bronchitis until the mucous membranes become habituated to the irritant. So, too, it is easy to understand bronchitis or tracheo-bronchitis which results from the irritation of steam or dusts. Thus, engineers, bakers, millers, stone masons, miners, brushmakers, polishers, housemaids who are engaged much in sweeping, furnish another contingent of cases of bronchitis. But the vast majority of cases of primary bronchitis arise independently of all these conditions and are commonly ascribed to the process of taking cold.

Secondary bronchitis develops in consequence more especially of the infectious diseases. Bronchitis belongs to measles, small-pox, hay fever, typhoid fever, and constitutes an integral symptom of these diseases. Bronchitis is also frequently found in connection with diphtheria, universally in connection with tuberculosis, also almost universally, at least periodically, in association with asthma and emphysema. There is also more or less bronchitis in pneumonia and pleurisy. Inasmuch as bronchitis shows itself in the infections

in the first part of the malady, it is fair to assume that the cause of the disease lodges in the bronchial tubes. The acute exanthemata arise from a contagium vivum, and bronchitis is the first expression of the irritation of micro-organisms, as a diarrhœa results from the action of intestinal parasites.

Secondary or symptomatic bronchitis occurs also in connection with mechanical disturbances of the circulation—that is, of nutrition of the bronchial mucous membrane. Bronchitis belongs to the later stages of heart disease, and shows itself in intensity in correspondence with the damage done to the heart. Thus bronchitis is more or less universal in tricuspid insufficiency. For the same reason bronchitis occurs in the course of cirrhosis of the liver or the kidneys. Every form of kidney disease which results ultimately in heart failure is attended with bronchitis. Bronchitis may arise also mechanically in the course of ascites or tumors of the abdomen of rapid course, which interfere with the action of the diaphragm.

The bronchitis which belongs especially to the chapter of bronchial catarrh is the malady which begins in the bronchial tubes, and which is ascribed to taking cold. "Catching cold" is really only a synonym for contracting disease, for bronchitis does not result from any change of temperature. Individuals plunge heated into a cold bath and emerge without bronchitis. Bronchitis is rare in the coldest regions; it is almost unknown in the Arctic zone. So, also, bronchitis is almost unknown in the prairies, in the open sea, at the tops of mountains—places where the air is rare and cold; not because the air is cold or rare, but because it is more pure. Colds are caught indoors, not out-of-doors. It is safe to say that most cases of bronchitis result from the action of micro-organisms of very great variety. Thus it is known that typical bronchitis occurs in connection with tuberculosis and pneumonia. But that bronchitis may result from the action of micro-organisms indirectly, and be due rather to their products than their presence, is shown in the typical bronchitis of typhoid fever, which is caused by a bacillus that is never found in the bronchial tubes. Individuals who live in the out-door air, and who are subject to the greatest exposure, the most marked vicissitudes of weather, seldom suffer from bronchitis. Sailors have bronchitis on shore, not at sea; soldiers in barrack life; inhabitants of cities rather than the inhabitants of the country.

Geigel states that more illegitimate than legitimate children suffer and die from diseases of the alimentary canal, but that more legitimate children die of diseases of the respiratory tract. Illegitimate children die from neglect, bad food, and legitimate from coddling and confinement to the house, protection from every exposure. House air, as contaminated by closed windows, ill-ventilated com-

partments, more especially by crowds in tenement houses, public assembly rooms, concerts, theatres, etc., schools and kindergärten, court houses and post offices, public buildings where men congregate and where the products of men accumulate—these are the breeding places of bronchitis. So the "cold" which is manifest on return from the theatre or ball room, if not present in latent form before, was caught in the room and not on the way home.

One of the most valuable acquisitions of our day in reference to bronchitis is the frequency with which it is caused by, or is the manifestation of, *tuberculosis*. Many cases of tuberculosis never go beyond the stage of bronchial catarrh, which may show itself in exacerbations and remissions, the real nature of which is only discovered by an examination of the sputum, or more readily and surely by the use of tuberculin with the Koch syringe, after the manner specified in the chapter on Tuberculosis. Statistics, such as are furnished by oculists in the examination of the eyes of children, when brought to bear upon the examination of the sputum of the school room, the work shop, or the public hall, may alone show how

FIG. 217.—Koch's syringe: action of piston substituted by rubber ball.

widespread is the catarrhal tuberculosis which is now known in most cases simply as an innocent bronchial catarrh.

Acute bronchitis shows but few *morbid changes*, however diffuse the disease or distressing the symptoms. The condition fades to leave no trace. The morbid anatomy of acute bronchitis is best studied during life, where it may be seen in the beginning of the bronchial tree. It has been abundantly observed that the same hyperæmia and swelling of the bronchial mucous membrane extends into the bifurcation of the bronchial tubes and into the bodies of the tubes as far as can be seen. It is seldom possible to see much further than the bifurcation of the bronchial tubes. At this particular part the signs of inflammation are pronounced. There is more or less diffuse redness, distinct swelling, even tenderness to pressure from the outside, which pressure will at times beget an exceedingly irritating, prolonged cough. A tough, tenacious mucus covers the surface. In more chronic cases the mucous membrane is more distinctly hypertrophied, more especially discolored to assume a slaty hue. Pigment deposits are found more or less abundantly distributed throughout the bronchial mucous membrane. Patches of atelectasis occur in connection with the emphysematous process in the vicinity.

Symptoms.—Scarcely any disease varies more in intensity than

bronchial catarrh; from the slightest grades of inflammation, confined to the mucous membrane of the trachea and main branches of the bronchial tree, which hardly show any symptoms at all, at least in adults, to more or less universal involvement of the finer tubes, with more or less complete occlusion, and hence dyspnœa, suffocation, convulsions—the picture of capillary bronchitis, with all intervening grades of intensity. Thus the disease presents totally different aspects. Inflammation confined to the trachea and large bronchi furnishes, as a rule, in adults but few symptoms. Constriction, irritation, a sense of rawness, more especially a sense of tickling, usually relieved by a sharp *cough* which literally scratches the mucous membrane in this region, slight expectoration of tough, tenacious mucus, few or no constitutional symptoms—this is the picture of ordinary bronchial catarrh as seen in adults. It does not in any way incapacitate the individual for work, or, as a rule, call for the use of drugs. In childhood and advanced life the picture may be quite different, even though the disease be limited to this region. The narrower calibre of the tubes in childhood produces a greater degree of *stenosis*, and the muscular failures of senescence lead to the accumulation of mucus, epithelial débris, etc., which may be aspirated in the deeper parts of the lungs, to lead here to symptoms of capillary bronchitis or catarrhal pneumonia. In childhood in these cases the cough is much more severe, the breathing more frequent, the distress from insufficient aëration of the blood more apparent. Duskiness of the face, *cyanosis*, somnolence, convulsions, coma, may occur in these cases, and are especially wont to occur where the individual is already debilitated by tuberculosis, syphilis, or rickets. The symptoms assume intensity in all cases as the disease attacks the finer bronchial tubes, until finally, when it invades the finest tubes to produce the so-called capillary bronchitis, the case assumes the gravity of real catarrhal pneumonia. In fact, the diagnosis between these diseases is well-nigh impossible.

The lighter forms of bronchitis show no *physical signs* on inspection. The chest movements are not inhibited. There is nowhere any consolidation. The air still finds access to the recesses of the lung, so that auscultation may disclose no sign of the disease. This is especially the case in the tracheo-bronchitis of adults, which is revealed only by subjective signs, and more distinctly by the laryngoscope, when the lining membrane of the trachea may be seen to be inflamed, the disease concentrating itself more especially at the point of bifurcation. Here, however, as elsewhere, the tubes may be silent, so far as physical signs are concerned. In the middle-sized tubes the diagnosis often rests upon the physical signs. This is more especially true of the differential diagnosis. There is still no limitation of the excursions of the chest. The chest walls

still rise and fall to the same degree as in the normal state. Mensuration shows no difference. No sign is yielded to percussion. Even slight lobular consolidations, more especially if central, may escape detection by percussion. All the more rich in signs is auscultation. As a result of thickening of the walls of the tubes, an obstacle is offered to the entrance of air, and coarse groaning, humming, sonorous *rhonchi* pervade the chest. What distinguishes them as belonging to this disease is not so much their character as their distribution. They are heard not only below the clavicles, but over the whole of the anterior surface of the chest, in the lateral regions also, posteriorly, behind the clavicles and below. The dry râles are indicative of the stages of hyperæmia and occlusion by the swollen mucous membrane. They give place, in the course of twenty-four to forty-eight hours, to moist sounds produced by the exudation of fluid. Every variety of moist sounds may be heard in the chest, from the coarse mucous râle to the finest crepitation. It is here, again, not so much the character of the sound as its wide distribution which is characteristic of bronchitis. The râles are symmetrical; they occur in both lungs; they are confined to no particular region of the chest. What again distinguishes them is the fact that they appear and disappear. A more profound inspiration or expiration, more particularly a sharp cough, may change the râles from moist to dry, or dissipate them altogether for a time; then they recur. The universality of the râles, their fugacity, their change in character, distinguish bronchitis from diseases which may show the same signs at certain periods or at certain places.

CAPILLARY BRONCHITIS.

Capillary bronchitis is recognized by the frequency of breathing, the respiration increasing to from 40 to 80 in a minute; by the increase in the fever, which shows temperatures ranging from 102° to 105°; by increase in the pulse rate, 160 to 180, in correspondence with the elevation of temperature. Notwithstanding the increased frequency of breathing, dyspnœa becomes more and more pronounced, the occlusion of the bronchial tubes leads to atelectasis, and the lung can now no longer follow the excursions of the chest. This limitation of movement becomes apparent with every act of inspiration. The supra- and infraclavicular fossæ, the intercostal spaces, the region about the insertion of the diaphragm, and the whole lower zone of the chest retract and sink with every act of inspiration. It is thus established that the lungs themselves, blocked in their bronchial tubes, remain more or less immobile. The defective expansion is shown more distinctly in defective aëration of the blood. *Cyanosis*, which reveals itself first to the practised eye about the lips, spreads gradually over the face; the finger nails assume a

bluish tint. In the course of a few hours or a few days the extremities, then the whole body, become more or less distinctly dusky or blue. The anxiety of the patient becomes intense. Hereupon ensues the pitiable struggle for air, the silent, pain-inflicting appeals to relatives for relief. As the cyanosis increases the sensitiveness of the nervous system becomes gradually obtunded, the struggle for air is less pronounced, the condition of excitement gives place to apathy, and there is at this time an apparent but illusory improvement. Convulsions ensue at any time during this stage. Comatose states, sudden heart failures, put a merciful end to the scene.

Capillary bronchitis is recognized for the most part by obtrusive signs. The frequency of breathing, the dyspnœa, the cyanosis, the fever, the nervous anxiety, above all things the retraction of the chest on inspiration, distinguish capillary from coarser forms of bronchial catarrh. In capillary bronchitis, which runs a more latent course, there is usually a history of catarrh which comes and goes, which seems more directly dependent upon the weather, which is present in the winter to disappear in the spring, or whose presence or absence may be determined by change of residence. There is a cough, which remains unnoticed because of its long continuance. Old men have a "coughing spell" in the morning for years, and then are compelled to cough little or not at all during the rest of the day. They must expectorate the mucus which has accumulated over-night. The disease is more or less continuously present in these cases, but is subject to exacerbations and remissions; and it is only when the exacerbation is attended by marked signs, as by increase of fever, violence of cough, pains in the limbs and joints, that the individual will say he has caught a fresh cold and attention is directed to the disease. Not infrequently the disease is recognized by the conscientious physician, who makes a thorough examination of the body in the hope of discovering somewhere a latent cause for the symptoms of prostration. In other words, a capillary bronchitis in general has the same history as a catarrhal pneumonia. There may be in cases no dyspnœa, no anxiety, merely an increased weakness which confines the individual to his room, to his chair, to his bed, and of which the cause is not apparent. The physician ascertains that the pulse is quick, that the skin is dry, that there is fever, that the amount of urine is diminished, its specific gravity increased, and its color heightened, and he more or less suddenly comes upon the bronchitis in the course of his examination. The chest movements are feeble; respiration is more or less abdominal. The tape line reveals not more than an inch difference, if that, between inspiration and expiration. There may have been made a diagnosis of general debility from old age. Percussion shows no dulness, as a rule, though there may be strips of dulness along the spinal column

—proof that the disease has associated unto itself a catarrhal or a hypostatic pneumonia.

Auscultation tells the story. A feeble, muffled, or absent vesicular râle, sibilant or sonorous rhonchi, scanty, tenacious expectoration tinged with blood, make the diagnosis. We look for the disease in childhood in connection with measles, small-pox, and typhoid fever. It is not infrequently a sequel of diphtheria ; it belongs to tuberculosis in all parts of its course. It assumes gravity in childhood for the reason, as stated, that the tubes are finer and the amount of swelling that would offer no appreciable occlusion in the adult lung produces stenosis in a child's lung. Then the tubes are shorter in a child's lung, so that diseased particles which would lodge somewhere along the surface of the big tubes of the adult penetrate to the recesses of the child's lung. Both childhood and old age are more liable to bronchitis from the fact that the power of expiration and expectoration is less marked. There is not the same resilience in the lung substance itself, and there is not the same muscle force outside the lung, so that in both these cases infections are liable to be introduced by aspiration from the mouth, from the throat, and from the larger bronchi. Mucus accumulates in the mouth and throat, mucus from the nose, epithelial débris, decomposing food, vomited matter, micro-organisms for which the mouth is a reservoir—all these materials may be aspirated into the recesses of the lungs, to produce first a bronchial catarrh, later even a putrid bronchitis or gangrene of the lung itself.

CHRONIC BRONCHITIS.

Chronic bronchitis occurs frequently as a result of the acute form of the disease, especially as the result of repeated attacks of acute bronchial catarrh, but much more frequently as a result of other affections of the lungs. Thus chronic bronchitis is a more or less constant companion of emphysema, tuberculosis, and chronic pleurisy, especially in its purulent form, empyema, and still more frequently it results from diseases of other organs which interfere with the circulation in the lungs. Thus heart disease, kidney disease, and diseases of the liver are attended at some time or other in their course by bronchitis, subacute or chronic.

Chronic bronchitis distinguishes itself by its subacute character, not only as regards duration, but intensity of symptoms. Violent symptoms in its course betoken acute complications, to which patients affected with chronic bronchitis are especially liable. The cough is not so frequent or severe, but continues over a longer time. Expectoration, on the other hand, may be much more abundant and different in many particulars. Dyspnœa is not, as a rule, so pronounced. It is a disease, however, which is by no means a trivial

affection. It may be, and often is, followed by complications of gravity. Nearly all cases of long standing show some emphysema. The chief damage, however, is done to the heart as a result of long-continued cough and strain. There occurs hypertrophy of the right ventricle, which in time must result in degeneration, dilatation, and incompetency. There are present then cyanosis, œdema, dyspnœa, syncope attendant upon heart failure, with, in more protracted cases, oliguria, with the consequence of stasis of the kidney, somnolence or insomnia, headache, dropsies, and coma. So, while, as a rule, chronic bronchitis is not a disease of gravity quoad vitam, it has a more or less grave prognosis quoad valetudinem, and may in special cases, more especially cases debilitated by other disease, still more frequently in age, be attended, through its consequences, with fatal results. The fact is continually to be emphasized that chronic bronchitis is rarely a consequence of acute bronchitis. It is mostly a secondary malady due to affections of other organs.

Bronchitis is often divided into two *forms*, according to the abundance of its secretion. Thus there is a *dry bronchitis*, the catarrhe sec of Laennec. This form of inflammation attacks more especially the finer bronchial tubes, where the same amount of swelling produces marked occlusion, and is characterized therefore by dyspnœa which seems out of proportion to the physical signs. There is no expectoration, there is sharp dyspnœa, more pronounced cyanosis, anxiety, nervous unrest, and distress. This form of bronchitis is found frequently as a consequence, or in the course, of measles, whooping cough, and tuberculosis, and, because developing gradually, is discovered more or less suddenly, especially in cases of apathetic, debilitated aged persons who have made no complaint that might call attention to the lungs.

BRONCHORRHŒA.

On the other hand, there is a form of bronchitis which is attended by such profuse expectoration as to merit the name bronchorrhœa. The discharge consists of thin, watery, frothy matter, which separates itself into layers. Pints or quarts of this fluid may be discharged in twenty-four hours. On rising from bed there is usually profuse expectoration of mucus that has accumulated over-night, more particularly in bronchiectatic cavities. The signs are not so distressing in this disease. There is no fever, there is little or no dyspnœa. The cough is not so harassing, because it is less continuous and more paroxysmal, and relief follows the expectoration of a quantity of fluid. Patients affected with bronchorrhœa may maintain a *bien-être* for years; the condition of health, however, in many cases becomes impaired daily, not infrequently because of associated, if not causative, tuberculosis.

BRONCHITIS PUTRIDA.

A particular alteration occurs in the sputum of some of these cases, constituting what is known as a bronchitis putrida, or fetid bronchitis. Putrid bronchitis seldom occurs as a primary malady or in people in perfect health. It shows itself in the course of ordinary bronchitis, usually in the course of bronchitis secondary to other diseases. The patient is more or less suddenly attacked by chilly sensations followed by an elevation of temperature, and then in the course of a day the discharge assumes a peculiar and offensive odor, a kind of sweet, rotten odor, "that of the mayflower or apple blossom, with a kind of *arrière-gout* of fæces" (Laycock). The matter separates itself distinctly into layers on standing—an upper layer, muco-purulent, frothy, with masses of more or less solid mucus from the coarser bronchi; a middle, a scanty, greenish, sero-albuminous fluid; and a lower, more or less distinctly purulent sediment, yellowish-green, the sediment consisting in large degree of smaller, more solid, caseous-looking masses, which Dittrich has shown to be expressions or casts of the finer bronchi, "Dittrich's plugs"—masses which crumble under pressure to emit that unspeakably offensive odor which makes the patient an object of disgust to himself and every one else. One such patient will contaminate the air of a ward in a hospital, of a large room in a factory, or of a whole house. The odor may be recognized upon opening the front door. It is impossible to account for the sudden change which occurs in the sputum in these cases. It is easy to see that the sputum abounds with micro-organisms, fungi—Leyden speaks of a particular form of leptothrix—all the bacteria of decomposition, fat products, and crystals; in fact, all the products of decomposition—sulphuretted hydrogen, ammonia, fatty acids, leucin, tyrosin—may be discovered in this sputum.

The disease is found in association at times with gangrene of the lungs, which makes itself manifest by the same offensive odor. But Traube has shown that the diseases are different; while they may coexist, they are more frequently independent.

Prognosis.—This form of bronchitis does not cease suddenly, as it began, but gradually, if it ceases at all. It is very obstinate to treatment. It shows itself in exacerbations and remissions for months, for years, sometimes for life. It might be supposed that putrid bronchitis resulted from the aspiration of products of decomposition from the mouth and throat into the lungs. Such an assertion may not be disproved, but it is a curious fact that individuals who work most with decomposing products, as tanners, scavengers, ragpickers, show no predisposition to it. It is, fortunately, the rarest form of bronchitis.

FIBRINOUS BRONCHITIS.

A peculiar variety of bronchitis is the so-called fibrinous bronchitis, or bronchial croup. This affection develops in consequence of tracheal croup or croupous pneumonia, only as a very great exception. As a rule the disease is secondary and occurs in the course of other affections of the lungs, chiefly in consequence of ordinary bronchial catarrh. The cause of this peculiar transformation is entirely unknown. The individual will have been, as a rule, in the enjoyment of his usual health, or that degree of it which belongs to ordinary bronchitis, when he is seized suddenly with chills or chilly sensations, to be followed by fever and symptoms of great distress on

FIG. 218.

FIG. 219.

FIG. 218.—Fibrinous bronchitis. Cast expectorated with the sputum.
FIG. 219.—Casts of the bronchial tubes expectorated in fibrinous bronchitis.

the part of the organs of respiration—that is, there is more or less dyspnœa, great constriction, profound anxiety, and feeling of impending suffocation, which indeed threatens and at times actually occurs. There is during the whole of the attack a most violent, harassing cough, which is attended in some of its explosive efforts with the discharge of *casts* of the bronchial tree. These casts alone establish the diagnosis. They may be recognized, often with the naked eye, as grayish-white masses of flesh-colored substances tinged with extravasated blood. They may be more readily distinguished, and are often only recognized at all, after immersion in water, when the branching of the bronchial cast is shown. They are thus dis-

tinctly casts of the bronchial tubes, and consist, in the smaller tubes, of solid masses of fibrin which have undergone hyaline transformation, enclosing a large number of white blood corpuscles with a few red. The smaller casts are solid; the larger, hollow and composed of concentric layers.

The sudden development of the disease with acute manifestations after chill and fever has led to the belief that fibrinous bronchitis is an acute infection, and analogy would place it in the same category with diphtheritic croup and croupous pneumonia, of whose infectious character there is no doubt.

The disease by no means always occurs in this acute form, though much more frequently acute. The chronic form occurs also in the course of ordinary bronchitis, as a rule, but is distinguished by the milder character of the symptoms. It runs a course for the most part without fever, and is a malady consisting rather of exacerbations and remissions than of continuous course. It is distinguished in its exacerbations by the same signs of distress as the acute form, and is absolutely recognized only by the expectoration of casts of the bronchial tubes. Both forms occur especially in the young, between the ages of fifteen and thirty years, with exceptions, however, in the extremes of life. Kisch, for instance, reports the case of an individual aged sixty-six years who suffered from repeated attacks of fibrinous bronchitis, and who expectorated at times, over a period of twenty-five years, masses which looked like collections of coral. Intervals of weeks or months, and sometimes even of years, with freedom from symptoms, distinguish some of these cases. Bugge, who collected the statistics of ninety cases with special reference to cause, found that the great majority followed in the course of chronic bronchitis and phthisis.

The character of the casts frequently locates the affection. Casts from the upper portions of the lungs subdivide more rapidly as the bronchial tubes of this part of the lung rapidly grow shorter. Ordinarily, bronchial casts are in their thickest portions about the size of goose quills, and subdivide gradually to the size of threads.

The acute form of the disease has a very grave *prognosis*, inasmuch as twenty-five to fifty per cent succumb within fourteen days. The mortality in chronic fibrinous bronchitis ranges about twelve per cent. Chronic fibrinous bronchitis distinguishes itself not so much by the intensity of its symptoms and its mortality as by its complications. Emphysema, atelectasis, and catarrhal pneumonia ensue in a certain number of cases.

The cause of this peculiar transformation of the secretion of the bronchial tubes remains involved in obscurity, and, as Kisch declares, the treatment, like the etiology, is as yet unexplored territory.

BRONCHIECTASIS.

The last variety of bronchitis is that pathological alteration in the walls of the bronchial tubes which permits their dilatation, to constitute what is known as bronchiectasis. This condition was not known until the time of Laennec, for the reason, as he states, that dilatations of smaller tubes were considered as normal tubes of larger size, and great dilatations of larger tubes were looked upon as vomicæ or cavities of phthisis. A closer inspection of the dilated tubes readily distinguishes them from normal tubes by their size at the periphery, inasmuch as normal tubes grow smaller gradually, tubes pathologically dilated terminate abruptly. Bronchiectasis occurs more frequently in the upper anterior portions of the bronchial tree, and concerns chiefly a few tubes of the third and fourth order. Tubes of the first order are never affected in this way. The disease is never primary, but occurs always in connection with other maladies, chiefly with long-standing chronic bronchitis, catarrhal pneumonia, and more especially tuberculosis. Corrigan, in 1838, furnished the most satisfactory explanation of development of most cases in his description of the fibroid condensations that occur in the lung, which were subsequently called interstitial pneumonia, later fibroid phthisis, and which we now consider to be relics, in all cases, of tuberculosis. The contraction of this hyperplastic mass of connective tissue, as in the process of cicatrization elsewhere, mechanically drags upon the tubes to force the deformity; and this deformity is aided all the more by the fact that the bronchial wall itself suffers from lack of nutrition, interruption of its circulation, and consequent degeneration. The deformity occurs in various forms: the uniform enlargement with cylindrical dilatation, with fusiform or spindle-shaped dilatation, saccular dilatation, with such consecutive saccular dilatations as to constitute the beaded appearance, or with such separation of the dilated portions, with retention of their contents, as to form cysts in the lung—a very rare condition.

The *diagnosis* of bronchiectasis is by no means always easy, for the clinical picture is that of the underlying condition of chronic bronchitis or tuberculosis. There are, therefore, all the signs which belong to chronic bronchitis—cough, expectoration, interference with circulation, and dyspnœa, more or less pronounced. Somewhat more characteristic is the *paroxysmal* character of the *cough* and the *discharge at intervals of large quantities of pent-up fluid.* The mouthful or more copious discharges, however, speak for bronchiectasis by no means positively, as abundant discharges, paroxysmal in character, are often seen in simple chronic bronchitis, and more especially in tuberculosis. Not infrequently, as is known, the dis-

charge from an abscess below the diaphragm, as from the liver, takes place in this way.

Physical signs are not especially marked. The chest expands. There is no percussion dulness, except in the presence of a very large cavity. Auscultation reveals only the signs that belong to chronic bronchitis or tuberculosis. The differential diagnosis of bronchiectasis from chronic bronchitis rests more upon the discharge of large quantities of fluid—as a rule exceedingly offensive from decomposition—at intervals. These symptoms, which may occur as episodes in the course of bronchitis, belong to the regular course of bronchiectasis. Tuberculosis is distinguished by its more or less continuous fever, its progressive emaciation, hæmoptysis, night sweats, etc., more particularly by the use of tuberculin, by the discovery of elastic tissue and the tubercle bacillus. Bronchiectasis has no definite duration. A developed deformity cannot be cured. The treatment is that of the underlying condition, upon the state or stage of which the prognosis rests.

Treatment.—Acute bronchitis is best treated by rest in the house, preferably in bed, and the use of diaphoretics. Thus an acute cold may be often cut short by ten grains of Dover's powder at bedtime, or by a grain of opium in any other form. Diaphoresis is often pleasantly and profusely excited simply by warm drinks, especially if preceded or followed by a warm bath. Common green or black tea, taken hot and in quantity, is a diaphoretic as effective as any of the nauseating infusions of the old materia medica.

In the acute bronchitis of childhood the warm bath plays the most important rôle, if given three or four times in the course of twenty-four hours. It is nearly always followed by peaceful sleep. Should diaphoresis fail, the treatment becomes purely symptomatic.

In relief of the cough appeal is made to the expectorants. Chief among the expectorants in our day ranks apomorphine. A good prescription for a child is :

℞ Apomorphinæ hydrochloratis.....gr. ss. to gr. i.
Acidi hydrochlorici diluti..... gtt. x.
Syrupi..... fl. ℥ ss.
Aquæ menthæ piperitæ..... fl. ℥ iss.
M. Sig. A half to one teaspoonful every two hours.

Apomorphine is a very soothing expectorant, which acts like an anodyne, and, as has been proved by experiment, has real virtue as an expectorant. In bad cases of cyanosis and dyspnœa the remedy is best used subcutaneously in doses of one-twelfth of a grain, increasing the dose if necessary. It should not be used in old age.

Ipecac in wine or syrup is a time-honored remedy, and, especially

in the form of the compound mixture, has a wide range of use. One grain of tartar emetic dissolved in a glass of cold water, of which a teaspoonful may be taken every hour, is an old and useful remedy. When the cough becomes very severe, and especially if it be associated with much pain, the necessity arises for the use of morphine, which may be incorporated with the apomorphine in the prescription above cited; or the opium may be given in tincture, simple or camphorated. Under no circumstances, however, should morphine be given to children. For an adult a prescription might read:

℞ Morphinæ sulphatis.....gr. i.
Aquæ lauro-cerasi.....fl ʒ ij.
Aquæ.....q. s. ad fl. ℥ ij.
M. Sig. A teaspoonful every two, three, or four hours.

The same relief, without risk, may be reached in children by the substitution of belladonna, which may be given, in the form of the tincture, in a dose of one drop for every year of the child's age. A few dry cups applied to the surface of the chest give great relief from pain at any age. Wet cups succeed when dry cups fail. Flying sinapisms often suffice. Where pain is very severe, in exceptional cases, especially in childhood, a poultice may be put about the chest.

For fever there is no remedy so good as *quinine*, which supports the heart while it attacks the fever. Many individuals learn to cut short a cold by a single dose of ten grains of quinine fortified by a drink of hot whiskey; and whiskey or brandy is always a safe remedy to give to a child, with a smaller dose of quinine—never over five grains. Relief from fever is also given by the other antipyretics—antipyrin, which may be given to an adult in the dose of from three to five grains, a child one to two grains; antifebrin in the same dose, or phenacetin in double the quantity. Phenacetin is the safest remedy. None of these drugs act so well in childhood as the warm bath; and where bronchitis has become capillary, and dyspnœa assumes prominence or actual cyanosis has occurred, no remedy ranks in value with the hot or warm bath, and cold affusions to the head and chest while in the bath. Jürgensen has shown that a small stream of cold water directed to the nape of the neck will cause deep inhalations. A debilitated child will require additional stimulation in the form of senega, carbonate of ammonium, caffeine, or digitalis. One drop of the tincture of digitalis every hour or two is at times invaluable.

The treatment of chronic bronchitis varies more with the intensity than with the character or form of the disease. The remedies which are of real value are few. Prophylaxis merits discussion first. As already remarked, bronchitis is the most frequent of all diseases, and the greatest contingent of cases occurs in childhood. When we re-

gard the manner in which children are brought up, in closed apartments with defective ventilation, too warmly clad, for the most part not regularly bathed, in the ill-heated, ill-ventilated habitations that constitute what is known as the house climate, it cannot be wondered at that bronchitis, a disease which results from the inhalation of a contaminated atmosphere, is so frequent. We have also to regard here, as well as in the case of adults, the frequency of tuberculosis, which has bronchitis as its forerunner for months and as its companion for life. Rickets, too, is a disease which belongs to childhood, and which has bronchitis as one of its prominent and more or less constant symptoms. These three causes—vitiated house air, tuberculosis, and rickets—account for the large majority of cases of chronic or constantly recurring bronchitis. In children bronchitis belongs, therefore, to those who are debilitated or diseased, and the factor of supreme importance in childhood is prophylaxis.

It is needless to say at this age that a house can be well ventilated, that sunlight and fresh air may be admitted, that the temperature may be regulated, that the house may be kept dry. Children affected with tuberculosis, rickets, and syphilis must be treated for these diseases. Phosphorus, iodine, creosote, cod-liver oil, iron, quinine—these agents belong as much to prophylaxis as to treatment. Weak and debilitated children and adults are best inured by *baths*, which should be warm at first—98° F.—then tepid, cool, and even cold, with brisk friction to the skin until the surface is brought to a glow, the perfection of the reaction being the indication of the grade of temperature for the next bath. Fresh air, exercise, a shorter stay in school, a better ventilated school room, are essentials in cure as well as prevention. The regulation of clothing, the avoidance especially of heavy underwear, of mufflers and comforters about the throat, the exposure of the body until it becomes hardened like the face—these are means which must be adopted gradually, that the body may become finally inured and, as it were, insured against bronchitis. A subject which deserves continued emphasis is the *destruction of the sputum*, which so often conceals the most dangerous parasites. Cuspidors, with water in them, should be in every room.

Old men are best protected by avoiding vicissitudes of temperature, especially as connected with moist or windy days. On cold, wet days the old man should remain at home in his room—in the chimney corner, if not in bed. The circulation of the old man is to be sustained by another meal—if necessary, later in the night—by wine, brandy, or an extra cup of coffee or tea. Senile bronchitis may be avoided also by change of climate. Individuals whose circumstances will permit should seek the warm, moist climate of

Florida, Southern California, the Bermudas, Nassau, or the dry, warm climate of Central Florida, Georgia, Aiken, Asheville, in the Carolinas.

Chronic bronchitis requires more continuous treatment. In the dry form of chronic bronchial catarrh exudation may be furthered or forced by inhalations. The agent of most value in these inhalations is *steam*, and it is best generated by a steam atomizer. Simple atomizers without heat are of no value. The steam is given some additional solvent powers by the use of common salt, more particularly the bicarbonate of sodium in saturated solution, or disinfectant properties with carbolic acid, thymol, or boric acid. In capillary bronchitis steam is a necessity. Where the discharge is excessive in bronchorrhœa the best remedy is *turpentine*, which should be given in the form of capsules containing from five to ten drops. Capsules of turpentine are swallowed without taste with milk, or five to ten drops of turpentine may be dropped into a wineglass of milk. Finally, turpentine may be smoked for a long time in a pipe ; here, however, there may be evidences of idiosyncrasy, such as slight cerebral disturbance and vertigo. A good substitute in these cases, or in any case, is terpin hydrate, which may also be given in capsule five to ten drops, or in pill one to two grains, three or four times a day. The balsams of Peru, tolu, copaiba, and sandalwood have virtue in individual cases. Cod-liver oil is food as well as medicine ; for children it is nicely compounded with malt. Many cases yield only to the prolonged use of iodine, which is best given in the form of iodide of potassium or sodium in peppermint water, in the ounce-to-ounce solution, beginning with from five to ten drops three times daily, largely diluted with milk. Its action is best suited to the cases complicated with asthma or dyspnœa. The best prescriptions for chronic bronchitis owe their virtue chiefly to the iodine they contain.

Putrid bronchitis requires antiseptics, which may be inhaled from the atomizer, as suggested above. Terpin hydrate is here also of value internally. A most excellent remedy recently recommended is *myrtol*, which should be taken internally in doses of five to six grains. Myrtol acts through the blood; it may also be inhaled. It lessens the excessive quantities of sputum in putrid bronchitis and bronchiectasis, diminishes the offensive odor or destroys it altogether, and often in the course of a few days puts a new phase upon a disease which has hitherto assumed alarming gravity.

Bronchiectasis has no special therapy. No drug can restore tone to or contract the dilated bronchial walls. The treatment is the same as that for chronic bronchitis, and more especially for putrid bronchitis, whereby disinfectant inhalations, more especially of terpin hydrate, menthol, and myrtol, play important parts. As has

been intimated, the diagnosis of bronchiectasis, or its differentiation from cavities in the lung from tuberculosis, is by no means easy. Moreover, inasmuch as these cavities are scattered throughout the lungs, there is none of that hope from surgical intervention which might be entertained where the affection is local.

In all cases of chronic bronchitis, especially where chronic organic changes have occurred in the bronchial walls, such as excessive hypertrophies, atrophies, decomposition of their contents, and ectasias, there is necessity for support with alcohol. *Senega* and serpentaria are considered good substitutes for squill, ipecac, and antimony in the debility of age. The carbonate of ammonium, best given in milk, is a remedy of value in advanced life or in extremis. The Germans have an anisated solution of ammonia which is a good preparation. Apomorphine is quick and pleasant, but not safe in age. A remedy which is of signal virtue in the chronic bronchitis of the aged, in the capillary bronchitis which may not be separated from catarrhal pneumonia at either end of life, more especially in the chronic bronchitis of old age associated with heart failure and kidney suppression, is *nitroglycerin*, of which one or two drops of a one-per-cent solution may be given every hour or two, or, to bridge over a sudden collapse, subcutaneously in doses of one to five drops. Benzoic acid is a fine stimulating expectorant. A failing heart calls for digitalis, tincture, gtt. v.-x. every two to four hours.

To sum up the therapy of bronchitis, the best remedy in the treatment of the bronchitis of childhood is the warm bath; the best remedy in the treatment of the acute bronchitis of maturity is diaphoresis; for chronic bronchitis the remedy suggests itself with the discovery and treatment of its cause, whether tuberculosis, emphysema, heart disease, or disease of the kidney; the best remedy for senile bronchitis is support of the heart and change of climate.

ASTHMA.

Asthma (ἀσθμάζω, to breathe hard); bronchial asthma; nervous, essential asthma.—A paroxysmal dyspnœa caused by a peculiar catarrh with spasm of the bronchi.

History.—The name of the disease dates from the period of symptomatic medicine, and the difficulty of breathing was a sign so obtrusive as to have fixed itself firmly in nosology. Hence asthma was a synonym for dyspnœa, and every difficulty of breathing that seemed due to obstruction in the chest was indiscriminately dubbed asthma. So forms of the disease multiplied with the effort to find place for various affections of the lungs and heart under this symptom. By the time of Sauvages (1768) there were no less than seventeen species of asthma, a number reduced to eleven by Richter (1822),

and gradually to two, idiopathic and symptomatic, in our own day. "Few terms have been so much abused in medicine or made to designate such different diseases" (Laennec). Though Willis and Cullen spoke of nervous asthma, it was not until the appearance of the paper by Ramadge (1835) and the prize essays by Bergson and Lefèvre (1836) that asthma was really regarded as a neurosis of the respiratory organs—a view which seemed established by Romberg (1841), who based his conception of the disease, as a spasmus bronchialis, upon the discovery by Reiseissen (1808) of muscular tissue in the finer bronchial tubes, and the contraction of these tubes under galvanization of the lungs by Williams (1840), and irritation of the vagus by Longet (1842).

Whatever doubt still hung about the contraction of the bronchial tubes themselves would seem to have been finally dissipated by Lazarus (1891), who devised an ingenious apparatus wherewith he could, with the aid of curare and tracheotomy, experiment upon animals in life, and whereby he produced the characteristic dyspnœa of the disease by irritation of the vagus nerve.

Wintrich (1854) and Bamberger (1870) attributed asthma to spasm of the diaphragm; Biermer (1870) reinstated the disease in the bronchial tubes; Lebert (1873) believed in both factors; Weber (1872) invoked dilatation of the blood vessels and tumefaction, vascular turgescence with rapid exudation, a bronchiolitis exudativa; and Störck supported this view with laryngoscopic demonstrations of hyperæmia of the larynx, trachea, and visible bronchi.

Etiology.—Asthma has been reduced to two forms—idiopathic and symptomatic, or primary (essential) and secondary. But it is doubtful if there be such a thing as an idiopathic, essential asthma. Every year narrows more and more the number of idiopathic cases with the discovery of some cause, immediate or remote, to account for the attack of the disease. These causes may be grossly divided into mechanical, chemical, and reflex, whereby many cases may fall under more than one head. Thus, among the mechanical causes may be cited goître, the so-called thymic asthma, aneurism, trauma, foreign bodies, dusts (pollen, etc., grinder's asthma), rickets, disease of the vertebræ (Pott's disease), disease of the heart (cardiac asthma), and certain diseases of the lungs, more especially bronchitis and tuberculosis. Under the chemical or toxic causes are renal, gastric, saturnine, mercurial, and malarial asthma, and the asthma produced by odors, also cases of arthritic and tuberculous asthma. Under the reflex causes are gastric, cardiac, sexual (especially uterine), intestinal (verminous), traumatic, and nasal asthmas. Finally, a small category of cases is to be attributed to psychic causes or ideas—

hysterical asthma. Most of these cases, it is plain to see, are cases of dyspnœa rather than asthma.

The exact method by which asthma is produced by any of these causes remains as yet unknown. It is assumed that there is some irritation in the centre, in the course of, or at the periphery of the vagus, which excites the muscular tissue to contraction, so that the existence of an idiopathic form in our day implies a concealed cause. It is better to assume a cryptogenetic than an idiopathic origin in all cases, if only because one stimulates, the other stifles, inquiry. While, therefore, it may be doubted whether there is such a thing as an asthma as a pure neurosis—*i.e.*, independent of an outside cause—it may be admitted that the sensitiveness of the nervous system differs in different people, and that certain individuals are more liable than others to attacks of asthma from the same cause. In other words, asthma implies unstable nerve cells of easy explosion, and takes its place in nosology by the side of epilepsy, insanity, migraine, etc., with which, indeed, it sometimes alternates. It is more in accord with modern medicine to look for the cause of the hyperæsthesia of the vagus in irritations caused by micro-organisms—diplococci, for instance, tubercle bacilli, etc., or toxines—rather than in "heredity."

Heredity plays a very insignificant rôle in the production of asthma. Age plays a more important rôle, in that, according to the statistics of Salter, of one hundred and fifty-three cases, one-fourth were under the age of ten and four-fifths under forty years. Sex, social position, and vocation have less to do with it. The disease occurs more frequently in males and in the luxurious upper class, but it is by no means rare among the poor. Teachers, clergymen, attorneys, people who lead sedentary lives, are rather more frequently affected.

Since Cullen made the first observation of the development of asthma in an apothecary's wife whenever ipecac was powdered in the shop, similar cases have been reported by most observers. There is, however, an endless variety of materials which may evoke asthma in a patient born with the asthmatic tendency. Thus the smell of a sulphur match, pitch, smoke, hay, tobacco; the rose, lily, and other flowers; coffee and the odors of the kitchen; odors of certain animals (cats, rats, dogs, horses, rabbits, guinea-pigs, chickens); the odors of wild animals (as in menageries), precipitate attacks. Literature is full of curiosities in this regard. The proprietor of an equestrian establishment suffered from asthma continuously until he retired from business, when the disease ceased, to return, however, whenever he returned to his horses. Fagge speaks of the case of a lady who was affected whenever she came into a room in which was a cat, no matter where the animal was hidden. Ramadge tells the

story of an employee in the East India Company who had to give up a lucrative appointment because the smell of tea developed an attack of asthma. Austin Flint was unable to sleep on a feather pillow. In one case the odor of roses brought on an attack, and so sensitive was this lady as to suffer a seizure on one occasion, though the rose which was held before her was artificial (psychic asthma).

The frequency with which an explosion of asthma has occurred in consequence of real odors should have sooner led to the investigation of the nasal cavity for sensitive areas. Voltolini long ago made the observation that asthma may be produced by a polypus in the nose. In one of his cases removal of the polypus relieved the asthma, which returned with the recurrence of the growth, to disappear again with its extirpation. These observations have been abundantly confirmed by observers, many in our own land, first by Hänisch, and more lately by Hack, Roe, Harrison Allen, and Bosworth; so that at the present time the tendency is to exaggerate the importance of the naso-pharyngeal genesis of asthma, or to consider that the disease results exclusively from this cause. According to Schmiegelow asthma has a nasal origin in thirty per cent of cases—*i.e.*, polypus twenty-two, rhinitis eight. Irritations about the larynx, especially of the interarytenoid folds, are much less frequent causes. Glasgow made an interesting confirmatory observation of such cause by the accidental application of a concentrated solution of carbolic acid to the larynx for some local affection, when the asthma with which the individual had suffered severely for years disappeared, never to return.

Errors, more especially excesses, in diet frequently excite an explosion of asthma. Attacks limited to certain days of the week can generally be traced to this cause. The peptic asthmas of the old writers were reflected indigestions, better explained in our day by gastric distentions and interferences with the circulation in susceptible subjects.

Colds account for the many cases associated with bronchitis. These are the cases in which attacks occur after every exposure.

Locality is a factor of etiology which cannot be overlooked. It has long been remarked—and the point was especially emphasized by Salter—that certain patients from the country get absolute exemption from an attack during a stay in the city. The immunity seems to be more assured or absolute as the air of the city is vitiated by soot and more especially by fog. London excels in this regard. Thus patients have come from the country to consult physicians in London, waiting for the development of an attack which never occurred, and have returned home in the belief that the disease was cured, to be attacked on the night of their return. And many

patients must make a regular habit of visiting the cities at stated intervals, or must make a permanent change of residence.

Symptoms.—As a rule asthma *sets in suddenly in the night*, and, in the majority of cases, without the slightest premonition. In exceptional cases prodromata, as a sense of oppression or uneasiness about the chest, are felt on retiring. Certain individuals experience unusual health, a feeling of exaltation, the meaning of which experience has taught them to understand. Usually the patient is awakened between midnight and morning, as with the nightmare, *with a sense of terrible weight and constriction about the chest.* He is unable to breathe, and must at once arise in bed in efforts to secure inspiration. In bad cases the patient seizes the bedposts or the side of the bed, to get points of support for the auxiliary muscles of respiration: the face wears a wild, anxious look; the surface becomes suffused and dusky; the alæ nasi play visibly; the vessels stand out distended in the neck. The patient speaks as little as possible; the speech is broken into syllables in economy of voluntary effort. There is no cough and no expectoration. The patient declares that if he could cough he could clear his lungs. Later in the course of the attack, when the patient can find time to cough, there is a scanty sputum in clumps or masses which contain *spirals, crystals, and eosinophile cells.*

The chest, notwithstanding the powerful action of the muscles, stands almost *immobile at full distention.* A superficial observation reveals the fact that *the main difficulty is with expiration.* There is difficulty in getting air into the lungs; to get air out of the lungs seems impossible. In bad cases the patient must get out of bed, fix himself in the kneeling posture beside the bed, or find some relative relief in standing, as at a mantelpiece with the elbows braced, or at an open window with the hands fixed on the uplifted sash, after methods found helpful in former experience. The descent of the diaphragm protrudes the abdomen; the powerful contraction of the abdominal muscles makes it hard as a board. During the attack the distention of the lungs is recognized by the *universal tympanites* on percussion, which often develops, in consequence of the tension of the alveoli, the *band-box tone.* The heart sounds are muffled or suppressed by the covering lung. Auscultation reveals *abundant sonorous and sibilant, later mucous or submucous râles*, which drown all other signs. Finally, after the lapse of several hours, the breathing begins to grow easier, the patient falls into a deep sleep, and awakens in the morning weary, but nearly as well as before. The attack repeats itself irregularly, sometimes on consecutive nights, sometimes not for several nights or a fortnight or more, usually with the occurrence of damp weather, and always with the development

of bronchitis, to which the patient is especially liable. In the inveterate cases the slightest exposure or imprudence precipitates attack.

Crystals and Spirals.—Leyden (1872) made a contribution to differential diagnosis in the discovery in the sputum of certain crystals, angular, elongated octahedrals, which might be supposed to be the active irritative cause of the attack. These crystals are found in grayish masses in the sputum, varying greatly in size, colorless or of a bluish tint, surrounded by masses of epithelium, and embedded often in certain peculiar structures known as spirals. Some of them are distinctly visible with the simplest lenses, but they vary so much in size as to be manifest, some of them, only with higher powers, as with a Hartnack No. 8. The crystals are insoluble in cold water, alcohol, ether, and chloroform, but are easily soluble in alkalies, mineral acid, warm water, ammonia, and acetic acid—which plainly allies them to mucin, a form of which Salkowski declares them to be. They are identical with the crystals discovered by Charcot in semen; which Klemperer has shown to be a phosphate of diethylendiamin; and by Neumann in the blood and marrow of cases of leukæmia. They are most abundant during and after the attack of asthma. Friedreich and Zenker found them also in the fibrinous plugs of bronchitis, and Bizzozero and Von Jaksch saw them in bronchial catarrh without asthma. They have been observed also as confirmations in the fæces in cases of helminthiasis. Most interesting is the fact that Lewy found them in nasal polypi, but more especially in the pale-grayish, gelatinous masses in patients not affected with asthma. He could not find them in the hyperplastic tissues or tumors encountered in certain cases of asthma.

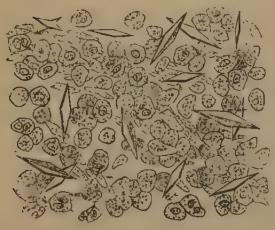


Fig. 220.—Asthma crystals.

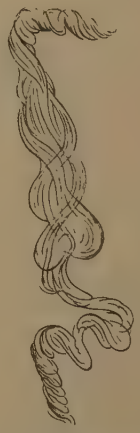


Fig. 221.—Curschmann's spirals in the sputum of asthma.

Leyden in the same year made the discovery in the sputum of asthmatic patients of the certain peculiar spiral structures alluded to above, which Curschmann later more fully described and advanced as characteristic of bronchial asthma. These spirals, the so-called Curschmann spirals, exist also in the grayish masses found in the sputum, often in connection, as stated, with the Charcot-Leyden crystals, in most frequent abundance at the beginning of an attack and in sharp, acute cases. They may be recognized even with the

naked eye in their largest size, but are better defined with the microscope of low power as elongated, spiral fibres grouped about a series of central and more open fibres, which present the appearance of a central canal. They exhibit, according to Vierordt, the finest forms of bronchial products, and hence correspond probably to catarrh of the smallest bronchial tubes (bronchiolitis exudativa). They are not exclusively present in asthma, but have been remarked also in croupous pneumonia and tuberculosis. These spirals also represent forms of inspissated mucus. They are, like the crystals, products, not causes, of a peculiar bronchial catarrh.

It has been remarked that the spirals exist in greatest abundance at the beginning of the attack, when the crystals may be entirely absent, to present themselves in greater abundance later in the history of the disease. Indeed, crystals have been made to develop directly from or in the spirals in sputum protected for several days from evaporation. From the fact that both crystals and spirals have been found in other affections, they cannot be regarded as pathognomonic evidence of asthma; but there is no doubt of the supreme value of these structures in differential diagnosis, for in any case of dyspnœa the existence of either crystals or spirals in the sputum speaks emphatically for bronchial asthma. Revealed, as they are, by a glance under the microscope, search for them in a doubtful case should not be neglected.

FIG. 222.—Spirals with crystals in sputum of asthma.

Further corroborative evidence is furnished by cell elements in the sputum. Müller demonstrated in the sputum of asthma numerous large lymphoid bodies, with pale-yellow pigment granules, which showed affinity or avidity for eosin—the eosinophile cells of Ehrlich. Lewy found these same cells in nasal polypi, especially in the gelatinous masses with but little gland structure.

Diagnosis.—True asthma is, as a rule, sufficiently easily recognized. The age of the individual, the time of its occurrence—*i.e.*, during the night—the suddenness of its onset, the intensity of the dyspnœa, above all things the difficult expiration, the sibilant and sonorous rhonchi, the great anxiety, the struggle for air—"Luft-hunger"—with the gradual cessation to complete relief and the free interval, the crystals and spirals and eosinophile cells, unmistakably stamp the disease.

The diseases which simulate asthma are, first, affections of the larynx, spasm of the larynx, false membrane, and œdema of the

larynx, to which may be added tracheal stenosis. But in all these cases *the difficulty is with inspiration, not expiration.* Inspiration is a long, powerful, stridulous struggle; expiration follows easily. There are no wheezing sounds in the chest. The condition is often recognized with the laryngoscope. Spasmodic contraction of the adductors or paralysis of the abductors shows the same inspiratory dyspnœa. Laryngismus stridulus is closely allied to asthma. It is also a neurosis with little or no associated catarrh. Paralysis of the posterior crico-arytenoid muscles is easily recognized with the laryngoscope. The vocal cords are found approximated, or separated by only a narrow chink. Œdema of the larynx occurs in consequence of acute laryngitis or of disease of the kidneys or lungs. Tracheal stenoses, unless due to foreign bodies, where the history is plain, are caused by neoplasms, syphilitic or carcinomatous, or by aneurisms, or by goître—conditions readily recognized by simple inspection or by evidences elsewhere in the body.

Certain diseases of the lungs, more especially bronchitis and emphysema, resemble asthma in the fact that expiratory dyspnœa predominates. It is often difficult to distinguish between asthma and emphysema because of their coexistence. Asthma produces emphysema, yet either may exist without the other. The emphysematous patient has the configuration and habitus of the chronic asthmatic. The dyspnœa is more or less continuous; it is aggravated by exercise, excitement, emotions. Its exacerbations, which simulate asthma, attack the patient more, therefore, when he is awake. True asthma occurs for the most part in sleep. Crystals and spirals, eosinophile cells, rare in emphysema, occur as a rule in asthma. Intermission is the rule of the dyspnœa in asthma, remission in emphysema.

Bronchitis distinguishes itself by its more gradual, never sudden, onset; by its more abundant cough and expectoration, which, at first mucous, may become purulent—a change which never shows itself in asthma. In bronchitis the wheezing sounds, although sometimes universal, are confined more especially to the posterior inferior lobes of the lungs. They are never so intense as in asthma. There is more or less fever—absent in asthma—in acute diffuse bronchitis, which form alone resembles asthma.

Dyspnœa from *heart disease* closely simulates asthma at times. Here too, however, the dyspnœa is more strictly dependent upon exercise or cardiac activity. In cardiac dyspnœa there is evidence of heart disease. There are valvular murmurs, accentuations, hypertrophies, especially dilatations, and other evidence of incompetence, irregularities in rhythm, general dropsies, scleroses of vessels, etc. The dyspnœa may become profound in cardiac disease, more espe-

cially in the later stages, in consequence of œdema of the lungs. Œdema of the lungs does not, however, show the same degree or the same kind of dyspnœa. Respiration in it is more shallow and superficial. It is not so much a question of obstruction as of infiltration. The expectoration is more profuse, watery, and is often tinged with blood.

Spasm of the diaphragm shows quite a different picture. There is a sudden, abrupt inspiration, often attended with hiccough and forcible fixation for a few seconds, then a quick, violent, expulsive effort. Spasm of the diaphragm is best seen in tetanus.

Intercostal neuralgia, which restricts the action of the respiratory muscles, may be distinguished by its painful points and by its pain in general. There is no wheezing, no cough, no expectoration.

Embolism of some of the branches of the pulmonary artery sometimes resembles asthma. Embolus is found in connection with heart disease. Respiration becomes suddenly irregular. There is intense anxiety, often expectoration of blood, profound dyspnœa—which differs from asthma in affecting both inspiration and expiration—marked prostration, and not infrequently sudden death. Often there is evidence of embolus elsewhere.

Renal asthma is found in connection with Bright's disease with its distinctive signs.

The *treatment* of asthma resolves itself into two problems: to cure or cut short the attack and to prevent its recurrence—*i.e.*, to treat the paroxysms, and to treat the patient in the intervals between the paroxysms.

1. The patient should be placed first in a comfortable position, which, in fact, he finds himself. There should be allowed the same latitude of disposition of the body in the paroxysm of asthma as in the pains of parturition. Tight clothing should be loosened, free ventilation secured, officious ministrations avoided. To sit up in bed with the elbows on the knees elevates the shoulders from the chest and gives additional points of support to the auxiliary muscles of respiration. This posture is usually taken at once. Many patients get this relief sitting in a chair with the elbows supported upon its arms; others kneel, with the elbows upon the chair or side of the bed, or seize the framework of the bed, or stand with the hands grasping the mantel or the elevated sash of the window. Individuals have found some comfort by supporting the shoulders on short crutches by the side of a chair, and various apparatus have been devised, armchairs with special supports, or head bands and shoulder supports swung from the ceiling—different postures for different individuals.

Should the attack be clearly due to indigestion, stomachic or

intestinal, the quickest means of relief is by an emetic or an enema. A cardiac or a renal asthma is often quickest relieved by a hot bath. Offensive odors, animals, flowers, feathers, drugs, should be removed at once, or the patient may be removed from their vicinity. The mere lighting up of a dark room at night suffices at times to relieve an attack, as was the case with Trousseau.

Inhalations.—The fumes of saltpetre have been used for half a century, and probably no single remedy has so wide a range of utility. It is, as Salter remarked, always a matter of surprise to learn that an individual has not tried this drug. Often it fails from improper use. The patient may make the solution himself, or buy it prepared, alone (chartæ potassii nitratis), or with other drugs. Ordinary blotting paper, not too thin or too thick, is dipped in a warm saturated solution of saltpetre, dried, cut in squares or strips, and ignited, the patient breathing the fumes as they rise. The room should be small—a closet with a partly opened door, a seat under an umbrella, or a tent of bedclothes over a chair to substitute the curtains of the old four-posters. It may be inhaled in any desired strength from under a funnel. If it is to act at all it acts quickly, usually exciting some cough at first; breathing becomes easier in a few minutes. Patients use it also as a preventive, inhaling the fumes for a few minutes before retiring or just after retiring, or they leave the strips in easy reach to be ignited with the first manifestation of symptoms. There are patients who prefer not to go to bed at all than to have to dispense with the fumes of nitre. It should be used at the very beginning of the attack. Sometimes it gives but partial relief; sometimes it succeeds at first and fails later; sometimes it fails utterly. The potassium nitrate parts with oxygen readily, and it is believed that its virtue in asthma is due to the nitrite which is left. The older practitioners used it also freely internally in doses of twenty grains, with twenty or thirty grains of the potassium carbonate, in a tumbler of water three or four times a day.

Stramonium is a still older remedy, having been introduced from India in 1802. The stramonium most used in our country is the leaves of the common Jamestown weed dried and ignited, or preferably rolled in the form of a cigarette. Stramonium may reach cases in which nitre fails. The converse is more frequently true. Stramonium is a more dangerous remedy. The danger is obviated by a cessation with the first confusion of sight or intellect. Both nitre and stramonium sometimes fail completely. They are more likely to succeed in toxic or purely bronchial cases, and fail in every way in nasal or naso-pharyngeal cases.

Coniine, hyoscyamine, and hyoscine are remedies which have been used as substitutes for stramonium, but they succeed only in

the most exceptional cases and in the face of greater dangers. More may be claimed for *atropine.* Belladonna was the favored remedy of Trousseau, who recommended that it be used for a long time with occasional intermissions. Belladonna relaxes spasm. Lenhossek, Harley, Salter, each advocate it strongly. Its best effects are obtained when used in a grain-to-the-ounce solution, beginning with from two to five drops and pushed gradually to tolerance. It should be given at bedtime, to anticipate the onset of the disease in the early morning.

The remedy which has the most sovereign control over the greatest number of cases is *morphine* subcutaneously. Morphine rarely fails to abort an attack of asthma. It should be given in doses of gr. $\frac{1}{8}$–$\frac{1}{4}$. Some of its evils may be counteracted by admixture with atropine gr. $\frac{1}{100}$–$\frac{1}{120}$. Morphine would be used universally, were it not for its unpleasant after-effects. It nauseates some patients and disturbs the digestion of nearly all patients. It produces discomfort for the whole of the following day. Most patients prefer rather to suffer an attack of asthma during the night than to endure the discomforts of morphine and disqualification for work for the whole of the following day. Then, too, morphine has the disadvantage that it soon begets tolerance. The dose must be gradually increased. There are authors who maintain that it is better to suffer the evils of morphine than the damage which protracted paroxysms of asthma produce. There are individuals who learn to use the remedy only in the worst attacks, and thus are not obliged to increase the dose. Stevenson in five years never increased the initial dose over one-sixth of a grain, with uniform success. It is not good practice to resort regularly to morphine; morphine is to be used as a *dernier ressort.*

Next to morphine—in the estimation of many practitioners, far above it—stands *chloral,* which often, indeed, "acts like a charm." Chloral is given in large doses—gr. xv.–xl. largely diluted—at once rather than in small doses frequently repeated. It acts quickly, relaxes the spasm, and gives the indescribable relief of a full breath in the course of five or ten minutes. No remedy has received higher praise; no remedy is more satisfactory in most cases; no remedy fails so utterly in many others, for when it fails it aggravates the case. It acts best in those cases which seem to be more strictly idiopathic. It acts worst in heart disease, where it is even dangerous. It is certainly not good practice to resort indiscriminately to chloral. The drug does not deserve the praise lavished upon it a decade ago. It falls short, if only because it fails to address the cause. It leaves the nervous system weaker than before. Yet both morphine and chloral are indispensable in certain cases. The practitioner must decide for the individual case.

To most patients relief, sometimes absolute, more frequently partial, but relief enough for sleep, is furnished by some one of the antipyretics—antipyrin, antifebrin, phenacetin, or quinine. For an adult there is usually required at a dose of antipyrin gr. x., of antifebrin gr. v., of phenacetin gr. xv., of quinine gr. x.; and one such dose at bedtime or at the beginning of the attack will, as stated, usually suffice at least to modify the attack. Quinine gr. v.–x. at bedtime is, as a rule, the better remedy.

Chloroform acts more quickly than chloral, and there is no case that will resist inhalations of this drug. Unfortunately the good effects of chloroform do not persist. The symptoms return after the cessation of its use. Where patients are compelled to use it for themselves, four or five drops should be let fall upon and inhaled from a handkerchief. Other anæsthetics of equal or nearly equal value are ether, iodide and bromide of ethyl, nitrite of amyl, and pyridin. All these remedies are to be inhaled in the same way from a handkerchief, except that pyridin is better administered by being poured—a dozen drops—upon a hot plate and inhaled in a small room or closet. It may be said of all these succedanea that they are of value only in the milder cases and that they will fail entirely in the majority of cases. And it may be said of chloroform that, while it may be inhaled in small quantities without danger, it becomes so dangerous in large quantities, often in sufficient quantity, and of such temporary value in all quantities, as practically to exclude its use.

In the case of fatty heart, where there is decided contra-indication to chloral, paraldehyde has been used as a substitute, best administered with the tincture of orange peel.

Tobacco is a drug that has no superior in persons not accustomed to its use. The profound nausea caused by the smoking of tobacco stops asthma like the wave of a magician's wand; and this may be said of any agent that has the same effect, as of antimony and lobelia. Nausea is the enemy of asthma, as of any other spasm. Unfortunately the remedy cannot be used by most males because of tolerance, and by most people because of the extreme distress of intense nausea. There are individuals, however, who have learned to smoke to protect themselves against asthma, and who have remained free from the attacks so long as they have used tobacco. But it is true of the majority of cases that the asthma will assert itself so soon as tolerance is established. Most patients prefer the distress of severe asthma to intense nausea, and are driven to emetics—ipecac by preference—only because experience has taught them the futility of everything else.

Mental emotions, a shock, a sudden surprise, excessive joy, grief, fright, a cry of fire, may cut short an attack at once. Knight tells

the story of an asthmatic who was relieved at once, in playing cards, so soon as the stakes grew high.

2. The success of the treatment of the interval, the prevention of the recurrence of the attacks, depends on the cause. In a certain percentage of cases the cause may be discovered in the nose, and removed by the use of astringents, emollients, boric-acid ointments, more especially caustics, chromic acid, trichloracetic acid, above all the galvano-cautery. The extirpation of polypi, the reduction of hyperplastic tissue, the destruction of sensitive areas, as localized often by ten- to fifteen-per-cent solutions of cocaine, have been followed by results as satisfactory as could be desired ; this, too, in cases where other treatment has been tried for years. Adenoid growths in the naso-pharynx, affections of the tonsils, cicatrices, ulcers, various affections of the pharynx, more rarely of the larynx, trachea, and bronchi, have all served as excitants of the explosions of asthma.

The remedy which enjoys the highest repute in the treatment of asthma in general, without reference to discoverable cause, is the sodium iodide, or, preferably, the *potassium iodide*, in gradually increasing doses. The patient may begin with ten drops of the ounce-to-ounce solution (peppermint water), and increase it to intolerance as manifested by coryza, with, in most cases, the most beneficial results. Of all the remedies which have been used in asthma none deserves so much praise as the iodides, probably because they address a hidden cause, which may be enlarged glands, cervical or bronchial, irritating the vagus nerve. Every practitioner may recall individuals who remain free of attacks of asthma so long as they are under the influence of an iodide. It is the remedy which is to be tried the first and longest. Large doses are best administered in milk. It is a rare case of pure nervous asthma which is not at least benefited, and many cases are actually cured, by the persistent use of the drug.

Next is *arsenic*, which should also be given in gradually increasing doses up to the point of tolerance ; then reduced, and continued in smaller dosage over long periods of time. Arsenic has manifold testimony as to its virtue. It was the remedy most relied upon by the older practitioners. Quinine is of signal value in individual cases. It is best adapted to those varieties of the disease which show some periodicity or recurrence.

Leyden, finding that the crystals found in the sputum of asthma were soluble in the chloride of sodium and carbonate of sodium, recommended the inhalation of one part of each of these agents in one hundred parts of water, twice daily, in the form of spray. Fauth says that the carbonate of ammonia liquefies the spirals. He finds it of value, therefore, in the therapy of asthma. Little could be

expected from the use of this remedy with our present knowledge of the relation to asthma of these structures.

Salter speaks highly of the use of alcohol in certain cases. It must be given hot and strong to be of any effect. Saturation with the bromides, as in the treatment of epilepsy, is an efficacious treatment in aggravated cases.

It has already been intimated that many patients are relieved absolutely by change of *climate*. In this regard also asthma has its freaks. Patients in the country are relieved in the city, and *vice versa;* patients in valleys by mountain air, and patients in the mountains by descending to the valleys. A moist, humid air will relieve most patients. Asthmatics are more often benefited at the seaside than in the mountains. So capricious is asthma that change of sleeping apartments from the ground floor to the upper story, or *vice versa*, may have the same preventive effect. The truth is, the patient must find his own climate, must sometimes make changes, and must remain as long as he may in the climate which is best for him. Florida, Southern California, the Bermudas, Nassau, the sea or its coast, and the inland lakes are points of selection.

Oxygen and compressed air are other resorts in the treatment of this disease. Patients are made to inhale compressed air in apartments or portable apparatus for hours at a time—sometimes to effect a cure, oftener to give temporary relief, often to fail entirely. As a general rule it is best to inhale compressed air and exhale into rarefied air. Those cases are most benefited which are most dependent upon bronchial catarrh. Asthma *per se* is little or but temporarily affected by pneumatic therapy.

The induced current of electricity—electrodes at the inner border of the sterno-cleido muscle, and sessions of from ten to fifteen minutes—has met with renewed advocacy by Schmitz, and has proven of value in exceptional cases.

EMPHYSEMA.

Emphysema (*ἐμφύσημα*, inflation) of the lungs.—Inflation, dilatation of the air cells, with characteristic deformity and dyspnœa.

History.—Definite knowledge begins with Laennec (1819), who gave the disease a name and distinguished two forms, the alveolar and interlobular, according as the air was found in the air cells or between them in the interlobular tissue. Laennec ascribed the disease to bronchitis, which permitted the ingress but prevented the egress of air, and thus dilated the air cells—the inspiration theory. Mendelssohn derived the pressure from expiration, basing his view upon the fact that efforts, as in labor, at stool, blowing instruments, especially with cough, distend the air cells. Gairdner developed

the condition from the extra work thrown upon certain parts of the lung on account of occlusion of other parts—compensatory emphysema. Rokitansky attributed the disease to nutritive changes, especially weakness of the elastic tissue, which permitted dilatation. Modern authors select one, especially the last, or unite several, of these views to account for the lesions of the disease.

Etiology.—Hard work, heavy straining, long labors, especially frequent and protracted paroxysms of coughing, furnish the conditions which develop emphysema. So emphysema may result from whooping cough, more frequently from bronchitis, and more especially from capillary bronchitis with asthma.

Compensatory or vicarious emphysema develops in connection with, or as a result of, diseases which interfere with the expansion of the lungs—occlusion of the bronchi, adhesions of the pleura, pneumothorax, ascites, deformities of the spinal column.

Interlobular emphysema results from rupture of air cells and escape of air into the interstitial tissue. Such rupture implies natural defect and violent effort, as in whooping cough, capillary bronchitis, dyspnœa.

FIG. 223.—Emphysema pulmonum: *a*, dilated intercapillary space with epithelial cell; *b*, empty spaces in alveolar wall; *c*, obliterating vessel; *d*, great defect in alveolar wall with still greater defect of capillaries (Ziegler).

From the nature of the avocation, males are affected more frequently than females; and, on account of the changes in nutrition, middle and advanced life more than youth.

Symptoms.—The disease is subacute and chronic, and is announced insidiously with a growing *sense of constriction, dyspnœa, palpitation of the heart,* which shows itself at first only after effort or cough, and gradually increases in degree to be, with exacerbations and remissions, more or less continuous.

Changes of climate, exposure to cold, errors in diet, any imprudence or extra effort, aggravate the disease. *Asthmatic attacks soon supervene;* the heart's action grows feebler, the extremities cool, the veins stand out in the neck, the muscles of the neck are hypertrophied; the chest is dilated in all directions, it begins to hide the neck so that the head comes to rest upon the shoulders, and the *chest assumes a distinct barrel shape.* Defective inspiration

leads to defective circulation, which shows itself in the *signs of stasis*—to wit, œdema about the ankles; oliguria, albuminuria, later parenchymatous nephritis with casts; *hypertrophy and dilatation of the right ventricle*, announced by accentuation of the pulmonary valve sound and pulsation in the epigastrium; later, duskiness of the face and cyanosis. Catarrh of the stomach, constipation, icterus, belong among the symptoms of digestive disturbance. Aggravated cases are marked by accumulation of fluid in the serous sacs, and anasarca.

Inspection reveals the external conditions—cyanosis, especially of the lips, ears, finger nails; ectasias of the finer vessels of the face; pulsation of the jugular, the bulb of which protrudes, in coughing, a sac as big as a thumb (Fleischer). The skin is mottled and shining. The auxiliary muscles of respiration are hypertrophied. The distention of the lungs in every direction elongates and dilates the thorax to the cylindrical or barrel shape. The heart is depressed and often concealed by the overlapping lung, so that its impact may be no longer felt. The diaphragm, with the abdominal viscera, is pushed upward. The dulness of the liver reaches to the umbilicus.

The conditions revealed by inspection are still more manifest to *palpation*, which may better appreciate the *defective excursions of the chest*, diminished or absent impact of the heart, and *diminished vocal and pectoral fremitus*. Mensuration more accurately marks the diminished expansion. The difference between inspiration and expiration, which should amount to three or four inches, is diminished to two inches or less. Sometimes, under the most powerful effort, the chest is not expanded at all.

Percussion yields a peculiar resonance on account of the distention of the alveoli and tension of the chest—the so-called *band-box tone* of Biermer. *Auscultation* shows an enfeebled vesicular râle. Inspiration is shortened. Expiration is scarcely to be heard at all. Bronchitis, which is associated with emphysema as a rule, especially with exacerbations which bring the patient to the physician, drowns everything else with its own peculiar sounds.

The *diagnosis* is determined by physical examination. The symptoms, which are closely simulated by asthma, are separated by the fact that asthma occurs in paroxysms, with intervals of complete freedom. Emphysema, though it varies in degree, is more or less continuous. Heart disease, cardiac dyspnœa, is distinguished by the history of the case, especially by preceding rheumatism, and signs of valve lesion or muscle weakness.

The *prognosis* is always serious. The disease is organic, and, when chronic or pronounced, incurable. The comfort of the patient

depends upon his surroundings. The individual who is compelled to work for a living has a hard fate and a short life. The patient in position to secure exemption from effort and change of climate longest postpones damage to the heart. Complicating bronchitis, asthma, especially pneumonia, intensely aggravate the prognosis.

The *prophylaxis* is protection against attacks of bronchitis, asthma, whooping cough, etc., regulation of the habits of life, especially with regard to exercise in the open air, the avoidance of errors in diet, exposure to cold, attention to the bowels, etc.

The *treatment* resolves itself into the treatment of the accompanying bronchitis, relief of strain upon the lungs, and support of the heart.

The treatment of bronchitis and asthma has been sufficiently remarked. The heart is best supported by small doses of digitalis, which may be given in the form of the tincture, five to ten drops three or four times a day ; or the infusion, teaspoonful to a tablespoonful every three or four hours; or the powder of the leaves, one or two grains with twice as much white sugar. The further treatment of heart disease and cardiac complications is discussed in connection with these affections. The only treatment which may be called specific is that of pneumatotherapy. Patients are made to inhale, with an appropriate apparatus (Heuck's, Williams', Waldenburg's), compressed air, and exhale into rarefied air. Change of climate accomplishes most.

CROUPOUS PNEUMONIA (*see Infections*).

CATARRHAL PNEUMONIA.

Catarrhal pneumonia, broncho-pneumonia, lobular pneumonia.—Catarrhal inflammation of the capillary bronchi and air cells, characterized by irregular fever, cough, dyspnœa, increase of respiration and pulse, disturbance of pulse-respiration ratio, carbonic-acid poisoning, indefinite duration, grave prognosis.

Neither the older anatomists nor the clinicians were able to distinguish that form of pneumonia which occurs in consequence of the extension of a bronchitis. None of the older writers mentioned a pneumonia in consequence of measles. The recognition of catarrhal pneumonia dates from the special studies of diseases of children. To Barthez and Rilliet is generally ascribed the credit of having first recognized this disease. The term is not very appropriate. The word catarrhal is used in distinction from croupous, with the understanding that the catarrhal process means an affection of the mucous membrane with exudation of mucus and, at the most, pus, whereas the croupous exudation is blood, fibrin, or transformed epithelium.

Neither term is likely to survive a definite understanding of the nature of both processes.

The distinction is often made between lobar and lobular pneumonia, understanding by lobular an inflammation which is confined to individual lobules but does not extend to involve an entire lobe. Inasmuch as the disease is always a secondary process and occurs in consequence of or as a result of bronchitis, the proper term for the disease is broncho-pneumonia. It should be understood from the start that a broncho-pneumonia does not exclude a croupous pneumonia. The processes not infrequently coincide, and the question is often one of predominance. Cases which are considered catarrhal resolve themselves not infrequently as croupous pneumonias, and, more rarely, cases which bear the aspect of croupous pneumonia turn out to be catarrhal. As a rule, however, the diseases may be distinctly set apart.

Some of the best pathologists and clinicians already subdivide cases of lobular pneumonia. Thus Fiedler distinguishes a broncho-pneumonia and a cellular pneumonia. The cellular pneumonia is not secondary to bronchitis, but springs up of itself in the air cells. The pneumonia of influenza is the typical cellular pneumonia. These various pneumonias are best distinguished by their etiology, the study of which explains also their relation to each other. Thus in Fiedler's fifty-five cases, in which the examinations were made by puncture of the lungs in life, the cause was found to be as follows :

	Fibrinous pneumonia.	Broncho-pneumonia.	Cellular pneumonia.
Diplococcus pneumoniæ Fränkel's	15	4	2
Bacillus pneumoniæ, Friedländer	2	1	1
Staphylococcus	2	4	12
Streptococcus	4	4	27

In five cases no bacteria were found. These findings coincide in the main with those of Weichselbaum.

Etiology.—Croupous pneumonia begins as such. It occurs suddenly in the midst of health, or that degree of it which goes with modern civilization. Broncho-pneumonia is always a secondary process. It occurs in consequence of bronchitis, and as a result, in the rule, of infections in which bronchitis is a prominent symptom. Thus broncho-pneumonia occurs most frequently in the course of, or as a sequel to, measles, next pertussis, then diphtheria. It may occur also in connection with variola, typhoid fever, scarlet fever, rubella. The rôle of "cold" may not be ignored entirely in the production of the pneumonias. Lipari found that animals which had remained healthy after the endotracheal injection of pneumonia sputum were

attacked with pneumonia immediately upon exposure to cold either before or after the injection. The cold weakened ciliary action and produced swelling of the mucosa, both processes which favored the growth of micro-organisms.

Broncho-pneumonia is a disease of the extremes of life. It occurs most frequently in childhood, next in old age, and shows itself in adult life only in individuals who have been debilitated by previous disease. Ziemssen found that sixty-seven of ninety-eight cases, and Stephen that fifty-two of seventy-two cases, occurred in patients under three years of age. Jürgensen ascribes it chiefly to the poisoned atmosphere of ill-ventilated apartments.

After tuberculosis and croupous pneumonia, it is the most common cause of death in old age. Most of the cases of death from senile debility and "old age," and many of the cases of "heart failure," are really due to the pneumonias. The disease process extends

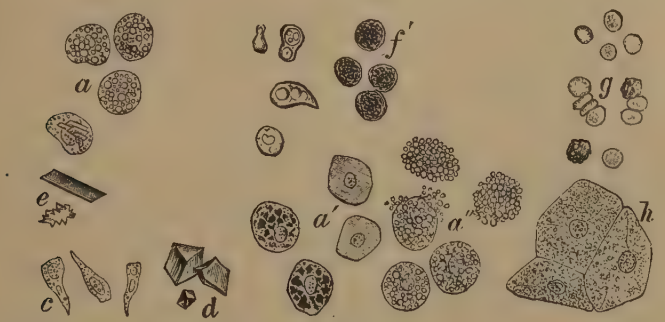


FIG. 224.—Cellular pneumonia. Alveolar epithelium from the sputum: *a*, *a'*, *a''*, alveolar epithelium; *b*, myelin forms; *c*, ciliated cells; *d*, crystals of lime phosphate; *e*, crystals of hæmatoidin; *f*, white blood corpuscles; *g*, red blood corpuscles; *h*, squamous epithelium.

to the air cells from the bronchial tubes by continuity of structure, or is inspired from upper into lower bronchi under the defective ciliary action of catarrhal inflammation and the muscular failures of protracted disease or senescence. Thus decomposing foods from the mouth or throat, and unexpectorated mucus, are inhaled or inspired into the bronchial tubes and bronchioles, to produce infection at the seat of final arrest. The disease is therefore a diffuse process. It occurs throughout the substance of both lungs, but is observed chiefly in the lower lobes and along the spine, where gravity assists its deposit.

Symptoms.—Broncho-pneumonia sets in, as a rule, insidiously. It is often impossible to draw the line between capillary bronchitis and catarrhal pneumonia. It is impossible to conceive of a marked case of capillary bronchitis without some catarrhal pneumonia, and it is safe to assume the existence of the pneumonic process in all

cases of capillary bronchitis. The process is assumed to develop itself, because the bronchitis does not yield to treatment or to time. On the contrary, the signs of bronchitis which have previously existed become more pronounced. The *temperature* runs higher. Fever, which may have been absent, or present in but light degree before, now begins to assume prominence and persistence. The temperature runs up in the evening to 102° or 103°, sometimes to 104° or 105°. The parents call attention to the *heat of the skin*, which is felt by the hand, or more especially by the face as applied to the chest in the act of auscultation. With this fever there is corresponding loss of strength, anorexia, and emaciation. The child is more and more peevish and fretful and restless at night as the fever becomes more marked. If there is anything characteristic about the fever it is its irregularity. The *temperature fluctuates* as the disease process changes in the lungs. The *pulse* is increased, and later on it becomes feeble and fluttering. *Respirations are markedly increased* from 20 to 30, 40, 50, 60, and more. They become correspondingly shallow and superficial. The older clinicians, in watching the acts of respiration, said "the breath flies." The most remarkable peculiarity is, however, the *disproportion between the pulse and the respiration.* Instead of the relation of 2 : 9 or 1 : 4½, the ratio becomes 1 : 3, 1 : 2, or 2 : 3. This disturbance in the *pulse-respiration ratio* is a sign of great value in the recognition of the pneumonias. So a child with a pneumonia, or even with an extensive diffuse bronchitis, is not able to make a sustained effort with the respiratory organs. *It cannot hold a long breath in crying.* It must frequently release its hold from the nipple in nursing. Henoch thinks so much of this sign that he has a child put to the breast to make this observation. The physician, in auscultating, may be well content to await the inspiration that follows a long cry, because the act itself excludes a pneumonia. Later on the picture of *carbonic-acid poisoning supervenes.* The sensorium becomes obtunded. There is cyanosis and coma; finally heart failure and death.

The *physical signs* furnish information of but comparatively little value. As a rule percussion shows no dulness, except in the most advanced cases where numerous condensed lobules have coalesced, or where in old people islets of condensation have extended to involve a large part of the lobe of the lung. Dulness in strips along the spine on both sides of the chest signifies catarrhal pneumonia. The auscultatory signs distinguish themselves by their number and abundance. They do not, however, especially distinguish the disease. The signs which are present are those of an acute diffuse bronchitis. There is every variety of dry and moist sound.

These sounds may be heard *universally over the chest.* They are usually heard in intensity in the back between the scapulæ and spine.

The *diagnosis* rests upon the existence of bronchitis, commonly in connection with measles, influenza, or some other acute affection; later in life, in connection with senile bronchitis or tuberculosis. The disease develops with fever, increase in the frequency of respiration and of the pulse, disturbance of the pulse-respiration ratio. The course of the affection is irregular, subject to remissions and exacerbations. It has no definite duration. The natural tendency of the disease is to extend.

Catarrhal differs, therefore, from croupous pneumonia in the fact that croupous is a primary and catarrhal a secondary disease process. Catarrhal pneumonia attacks especially the extremes of life, infancy and old age; croupous pneumonia is more frequent in childhood, but is not infrequent in all periods of life. Croupous pneumonia begins suddenly, catarrhal pneumonia so insidiously as to make it impossible to fix the time of its inception. There is seldom in catarrhal pneumonia pain, which is often acute in the beginning of croupous pneumonia. The brick-dust, glutinous sputum is peculiar to croupous, mucous and purulent sputum to catarrhal, pneumonia. Microscopic examination of the sputum reveals in croupous pneumonia the diplococcus, which is only exceptionally present in catarrhal pneumonias. Croupous pneumonia terminates, as a rule, in from five to nine days; catarrhal pneumonia has no definite duration, but extends over weeks.

Catarrhal pneumonia is separated from tuberculosis by the localization of tuberculosis, more especially at the apices, by the action of tuberculin, and by the detection of the tubercle bacillus.

The *prognosis* is always grave, even in infants where the future of croupous pneumonia is favorable. The bronchial tubes in infancy are so small as to be more or less completely occluded by a degree of inflammation which would have no effect upon adult tubes. In age the advantage in the size of the tubes is counterbalanced by the muscular failures of senescence. Taking cases as we find them, with what improvements in environment we are able to surround them, the mortality reaches forty per cent. The danger in catarrhal pneumonia is double: first, on the part of the lungs, in that so much lung tissue is blocked off as to lead to death by suffocation, by carbonic-acid poisoning; and, secondly, catarrhal has the danger of croupous pneumonia of weakening the action of the heart, and, though the toxic effect of the disease is not so immediately pronounced, long duration of it finally breaks down the heart. The right ventricle becomes dilated and flabby; heart failure develops.

Treatment has therefore the double object of stimulating the

respiratory centres and sustaining the heart. Expectorants cannot accomplish much. Choice may be had of ipecac in the wine or syrup, or the compound syrup of squills, or apomorphia, which has the advantage that it may be given, in advanced cases, subcutaneously. The older practitioners still administer antimony up to emesis—a practice that must not be pushed too far. Opiates are always dangerous. They merely mask the disease. They are better substituted by chloral, or may be admitted only in the form of Dover's powder. The best stimulant to the respiratory centre is the bath. A child should be put in a bath whenever the temperature reaches 103° in the rectum, and the temperature of the water must be so regulated as to reduce this temperature two degrees within half an hour after the bath. The warm, the lukewarm, or the cool bath, with cold affusions upon the head, constitute the most powerful respiratory stimulus we possess. A child in the height of bronchopneumonia should be put in the bath perhaps half a dozen times in the twenty-four hours. Antipyretics are of little value. A dose of phenacetin may secure sleep at night. It should be given always with a little whiskey or wine. In the presence of pain hot applications may be made to the chest. One may not speak derisively of the value of mustard plasters in the more protracted cases. The mustard may be made less irritating by admixture with flour or with the white of egg. In age the strength must be sustained with alcohol. The more stimulating expectorants—senega, ammonia, camphor, benzoic acid—must substitute emetics. A drop or two of nitroglycerin two or three times a day will make a quick appeal to the heart, especially in the presence of sclerotic vessels. Digitalis sustains it best in the long run. Creosote and iodine are remedies of great value in more protracted cases. Cod-liver oil, good food, fresh air above all things, change of climate in more chronic cases, best meet the indications of treatment. Further details of treatment may be found in connection with Bronchitis.

HYPOSTATIC PNEUMONIA.

What knowledge we have regarding the process of hypostatic congestion we owe to Piorry, who showed that the congestion of the lungs which is found on the postero-inferior aspect in dead bodies was not a post-mortem phenomenon. He placed bodies after death on the side or on the stomach, and observed that the blood did not leave the region of its first deposit. On opening the body the hypostasis was still found on the posterior surface. Piorry had distinguished the condition during life. Hypostatic congestion occurs in all cases of profound prostration or long debility. It is, therefore, seen most frequently in old people, whose lives are often curtailed by

this process, but is observed also at any period of life as the result of prolonged decubitus, more especially of failures on the part of the heart. So victims of protracted tuberculosis, carcinoma, chronic infections, typhoid fever, rheumatism, paralyses, fractures of bone, etc., furnish the large contingent of cases. The condition occurs also not infrequently in the course of heart disease and catarrhal pneumonia, and displays itself by the signs of impeded circulation.

Symptoms.—Piorry called attention to the fact that old people at the commencement of the disease begin to *sleep with the mouth open*, in order to secure the entrance of more air. A light *cyanosis* about the face often betrays the first hypostasis. Later the face is seen to grow more dusky and *œdema of the lower extremities* sets in. There is now *dulness to percussion* at the base of the lung, ascending upward from below. Respirations become more shallow.

The *treatment* consists in the frequent change of posture—*i.e.*, in turning the patient upon one side or the other, or upon the face, or especially to bring him to a semi-recumbent posture. Caffeine, the soda benzoate gr. iij. every two or three hours, camphor, nitroglycerin, digitalis, best stimulate the heart. *The patient must be taken out of bed as soon as possible.*

Embolic pneumonia is a complication of heart disease, and *septic pneumonia* of pyæmia.

ŒDEMA OF THE LUNGS.

Œdema (*οἰδέω*, to swell) of the lungs.—The passive escape of serum, containing red blood corpuscles, through paretic vessels into the interstitial tissue, alveoli, and bronchi; characterized by universal râles, cyanosis, dyspnœa, and asphyxia. The condition was formerly considered a result of hydræmia, a view which was disproved by Cohnheim and Lichtheim, who showed that œdema did not result from the inundation of the blood with large quantities of the physiological salt solution (0.07 per cent). Welch developed œdema in some experiments in which he weakened the action of the left ventricle, leaving the right intact. Interference with the escape of blood from the left ventricle leads to the same result. The frequency with which the condition is found in connection with Bright's disease, tuberculosis, cancer, leukæmia, bespeaks the influence of disease of the vessels. Œdema of the lungs sometimes occurs suddenly in health, after copious cold drinks, hot baths, after paracentesis. A satisfactory explanation of these cases is wanting. The affection is bilateral, begins in the lower lobes, and gradually ascends.

Symptoms.—Sometimes the condition develops insidiously, sometimes suddenly. The symptoms result from defective aëration of the

blood, and are the same whatever the seat of the occlusion. Œdema of the lungs is usually announced by interference with respiration, by *rapid respiration*, appeal to all the auxiliary muscles, increasing *cyanosis*, sense of *suffocation*, and *anxiety*. The face wears the look of desperation. *The sputum is thin, foamy, tinged with blood.* In disease of the kidneys it contains *urea*. Inspection shows the limited excursion of the chest. Percussion gives dulness below, increased resonance, even tympanites, above the infusion. Auscultation discloses *universal mucous and submucous râles*, which drown all other sounds, which may be felt in palpation, may be heard by the patient himself, and often by others in the vicinity.

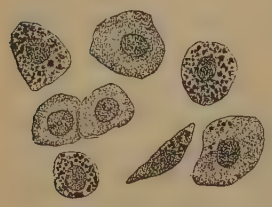


Fig. 225.—Œdema pulmonum. Desquamated epithelium enclosing particles of coal. × 300.

The *prognosis* is always grave, but depends upon the underlying cause. Where the disease is not irremediable, and the heart can be forced to extra work, the patient may recover. Death is by heart failure and carbonic-acid poisoning.

The *treatment* consists wholly in appeal to the heart by caffeine, the soda benzoate, which may be administered internally or injected subcutaneously in doses of two or three grains every hour or two; digitalis infusion, dessert- to tablespoonful every two or three hours; alcohol. The hot bath, hot pack, may, by derivation to the surface, unload the congested vessels in the lungs. For the same purpose a venesection is justifiable in florid cases.

ATELECTASIS.

Atelectasis (*ἀτελής*, ineffectual, *ἔκτασις*, expansion); hepatization; splenization.—A collapse of the lung, congenital or acquired, which results from defective expansion, or from occlusion of bronchi, with reabsorption of gases, first of oxygen, then of carbonic acid, last of nitrogen.

Etiology.—Congenital atelectasis results from lack of expansion, on account of injury to, or death of, the respiratory centre, as in compression of the umbilical cord, protracted labor, premature birth, etc.

Acquired atelectasis occurs in consequence chiefly of occlusion of bronchi with mucus, false membrane (croup), meconium, blood, foreign bodies, or of processes which interfere with expansion, effusions into the pleura, pneumothorax, deformities of the vertebræ (tuberculosis and rickets), ascites, protracted tympanites, etc. The condition may be limited, localized, in individual bronchi; or exten-

sive, involving numerous lobules, lobes, or the greater part of the lungs.

Symptoms.—Atelectasis limited to a lobule or a few lobules may show no signs. Unaffected parts of the lungs supply the defect. Compensation may be excessive and result in emphysema. Where one-sixth to one-eighth of a lung is involved the symptoms are distinct. The new-born child is born *asphytic; the surface is blue and cold.* The child may be born dead or dying, so that efforts at artificial respiration, particularly swinging by the feet (Schultze's method), must be resorted to; or the respiration is feeble, the chest fails to expand, *the intercostal muscles sink in* as in inspiratory dyspnœa; there is no cry, or *the voice is feeble and whimpering.* The patient slowly recovers, or death occurs from heart failure, thrombus of a brain sinus. Inspection reveals *immobility of the chest,* with collapse of the intercostal spaces. There is lessened resonance to percussion, enfeebled vesicular râle, diminished fremitus, and, with extensive consolidation, bronchial respiration. Capillary bronchitis and bronchial pneumonia easily supervene.

Diagnosis.—The condition is to be separated from hæmorrhagic infarction, which shows bloody sputum, pain, and pleuritic frictions. Croupous pneumonia distinguishes itself by fever, crepitus, and short duration; pleurisy by pain and friction sound, change of the line of dulness with change of position, and absence of retraction of the chest on inspiration. Slight atelectases may be suspected on account of the superficial respiration, reduction of temperature, changes in circulation, which cannot be accounted for in other ways.

The *prognosis* varies. Asphytic children may be recovered by artificial respiration, baths, douches of cold water, faradization. The outlook is worse with premature births. In the acquired form the prognosis depends upon the cause. Associate pneumonia or tuberculosis, stenosis of the pulmonary valves, permanence of the foramen ovale, make the prognosis grave.

Treatment consists in stimulation of the respiratory centre by the methods referred to. The asphytic child is to be kept warm, and, with established respiration, laid upon its right side. Stimulants, a few drops of brandy in hot water, may be administered from time to time. In the acquired cases the treatment is the same as that of broncho-pneumonia.

DROWNING.

Drowning is the asphyxia produced by submersion in fluid media. Death by drowning occurs by accident, suicide, and homicide. In the reign of Charles V. drowning was inflicted as a death penalty for child murder; and as late as the end of the seventeenth century,

in certain countries—Styria and Tyrol—the body of the suicide which was refused consecrated burial was put on a boat and sent adrift.

Accidental drowning is not so common since the rail has so largely substituted the river. Nevertheless it occurs not infrequently among pleasure seekers, yachting parties, etc. Boys are drowned more frequently than girls. Girls remain at home and are more frequently burned. Drowning sometimes occurs in the bath tub in sudden syncope, alcoholism, epilepsy, apoplexy, etc.

Homicide by drowning is rare. In a thousand cases collected by Belòhradsky homicide by drowning occurred in but twenty-three, and then, as a rule, under peculiar circumstances. Thus, Henle recorded a case where a laborer, driven to desperation through want, drowned his four children; Casper-Liman, a lithographer who drowned his four children; Maschke, an insane woman who pushed her two daughters into the water. But drowning of the new-born is frequent. Nearly one-third of the violent deaths of the new born occur in this way. The new-born may have drowned in the liquor amnii by premature respiration (breech presentation) during as well as after birth.

Suicide numbers the most victims, and chiefly in the female sex. Ever since Sappho plunged from the cliff, unhappy women have found relief in death by drowning. But statistics differ. Thus suicide by drowning occurs in Vienna in but 5 per cent of cases, in Paris in 21.5, in Italy in 38 per cent. The little piece of the Seine which runs through Paris numbers more victims than all the rest of the river, or than any other part of a river of the same length. Drowning is naturally more frequent where opportunity is more abundant. It is rare in inland cities away from rivers, lakes, reservoirs, etc. *Locus aggravat crimen.* But a very small amount of water is necessary to drown. Devergie relates a case where a mother took her four children to a canal in which the water was but two feet deep, prayed with them, and plunged with them into the water. The mother and youngest child were rescued alive. Smith reports the case of a woman who cut a hole in the ice and held her head in it until she drowned. Drunkards and epileptics have drowned in water insufficient to cover the entire head. If the face can be held in water for half a minute, or until asphyxia occurs, the individual loses the power to rescue himself and his fate passes out of his own hands.

The specific gravity of the body is greater than that of water, hence there is a natural tendency to sink; but the tendency is not great, and but slight effort is required to keep the face above water. The greatest weight is in that part of the body out of the water and unsupported by water; hence struggle in the effort to escape, as in

throwing the hands out of the water, increases the weight of the body. Fat is lighter than water, hence fat people, women, and children float more easily. The head, from its weight, sinks most readily. The body generally rises to the surface during drowning until the air from the lungs escapes in bubbles, and always after it in the course of two or three days, unless restrained by weight or entanglement. The gases of decomposition suffice to lift the body to the surface.

The immediate sensations of drowning are really agonizing. They attend the struggle for air, which is always powerful and painful. But the struggle is of very short duration, and *dyspnœa* is quickly succeeded by loss of consciousness and *convulsions*. An *indescribable delirium, with ringing of the ears*, is quickly followed by *loss of consciousness*, and the period immediately preceding the loss is attended with sensations at times pleasurable. Marryatt said the feeling was not one of pain, but "of sinking into sleep in the long, soft grass of a cool meadow." Sometimes drowning is entirely unattended with struggle, as after injury to the head, in epilepsy, apoplexy, syncope, alcoholism, etc., when the body sinks at once like a mass of lead, to rise no more.

The duration of submersion necessary to produce death varies. Children, especially the new-born, withstand asphyxia longer than adults, in whom two minutes usually suffice to take life. Johnson, the champion swimmer of England, could remain under water three minutes and ten seconds. Dogs die in four minutes.

Recovery from asphyxia by drowning is more difficult than from other cause. Water exercises an injurious effect upon the lungs. A dog with his windpipe plugged to prevent the ingress of water may be recovered from asphyxia after four minutes' submersion, while a dog not so protected succumbs.

The various signs of death by drowning are, for the most part, deceptive. The blood is usually dark and thin ; the internal organs often, but not always, hyperæmic. The skin is covered with goose flesh from contraction of the cutaneous muscular tissue. Mertzdorf called attention to the extreme cold of the drowned body. This is especially observable in bodies drowned in fresh water and after partial removal of the water. The coldness is due to rapid evaporation from the saturated epidermis. The epidermis itself shows signs of maceration, most marked where thickest, as in the palms of the hands and soles of the feet, and most marked on the hands of the laborer. The degree of maceration is an index also of the duration of submersion. Signs of maceration show themselves in the pulps of the fingers and eminences of the hand in two to three hours, in the palms which assume a sodden appearance in two to three days.

The whole hand becomes chalk-white in five to six days. Decomposition shows itself from above downward, and depends in degree and time of occurrence upon the exposure, season, temperature, fluid, etc. Thus it occurs earlier in summer and in sewage. It becomes often a nice question in forensic medicine to determine whether a body was drowned, or was thrown into the water after death from other cause. The question depends largely upon the evidence of breathing in water. In the convulsions and terminal struggles of drowning water may be swallowed and its presence recognized in the stomach. Unfortunately the stomach generally contains fluid. The discovery of fluid of particular character, liquor amnii, sewage, etc., furnishes evidence of more value. Fluid, or more particularly fine foam, in the lungs—*i.e.*, issuing from the bronchial tubes and trachea like foam from a beer bottle—may likewise indicate aspiration of

Fig. 226.—Marshall Hall's method.

water. Here too, however, is room for doubt, as the same condition may be encountered in other states, as in œdema of the lungs, etc. Of most value is the sign furnished by Hofmann—the detection of fluid in the middle ear. Fluids, even chemical test fluids, as the ferrocyanide of potassium, do not penetrate to the middle ear in bodies submerged after death. The discovery of fluid in the cavity of the drum is therefore evidence of great value, especially in the case of the new-born, in whom the observation is easily made by cutting out the roof of the drum with a pair of scissors after removal of the brain in this region. Any fluid present is withdrawn by a pipette and examined under the microscope. The operation is more difficult in the adult and requires the use of the chisel. Penetration to the tympanum does not occur in cases where death takes place without struggle. The finding of fluid in the cavity of the drum is therefore not universal in cases of drowning.

Although death usually results from submersion of a few minutes, cases have been rescued after much longer periods. Sometimes in these cases the submersion has not been complete or the body has come to the surface repeatedly and some air has been inhaled. Newborn children have been rescued after submersion for ten minutes. A most remarkable case is reported in the *Annales d'Hygiène Publique*, vol. xliv., page 306, of the rescue of a boy aged fifteen after sub-

FIG. 227.—Sylvester's method.

mersion for nearly an hour. Efforts at resuscitation should not be abandoned after submersion short of one hour. In all cases attempts should be made to empty the air passages of water. The older methods of suspension by the feet or rolling the body over a barrel are bad. The body should simply be inclined downward, as on the bank of a stream or in a boat, the chest raised with the clothing, and compression exercised from below upward by the hand over the stomach. The diaphragm may be thus forced upward and the water extruded

FIG. 228.—Sylvester's method.

through the open mouth. Wet clothing should be immediately removed, the body quickly dried and warmed with hot-water bottles. Fires may be made in the vicinity and stones heated as substitutes. Remarkable results have been reported from the application of hot water alone. The clothes saturated with hot water, 110° to 140° F., and applied about the surface, stimulate the centres of respiration through the skin, as does exposure of the skin in the first acts of breathing in the new-born.

Various methods of rescue have been proposed. They depend entirely upon securing artificial respiration.

The first method devised was that of Marshall Hall. It consisted in turning the body over on the side to secure expiration and turning it back to secure inspiration.

The method of Sylvester was an improvement. Sylvester's method consists in raising the arms above the body by the side of the head to secure expansion of the chest and inspiration, and then depressing them again by the side of the body, with some compression, to secure expiration. Satterthwaite suggests also the withdrawal of the tongue to keep the larynx open.

Howard's method is a further improvement. The operator bestrides the body, places his hands upon the front and sides of the chest, with the thumbs by the side of the sternum, throws his

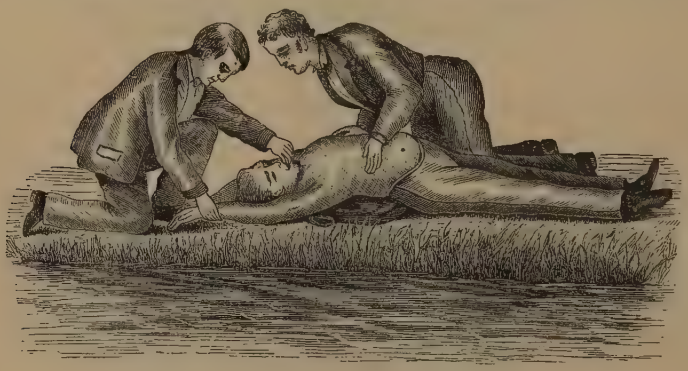


Fig. 229.—Howard's method (Satterthwaite).

weight forward upon the body, making at the same time lateral compression, while he counts one, two, three, or up to five; and then, with a final push, in which the hands are assisted with the knees, throws himself back, that the chest may recover from the compression with a spring. These various acts of compression are made first slowly, and gradually more rapidly until some signs of life appear.

Bad signs are drooping, half-closed eyes, rigid, incurved fingers, extreme and persistent coldness of the surface. The first signs of respiration are twitching of the muscles of the face, slight flushing, and gasping respiration. Bodies submerged for but a short time soon begin to gasp and speedily recover.

EMBOLISM OF THE LUNGS.

Embolism of the lungs; hæmorrhagic infarction.—Infarction results from the occlusion of pulmonary arteries by thrombus or em-

bolus. It may result only when the circulation of neighboring capillaries is insufficient to counteract the stasis, which condition may occur in connection with affections of the lung or insufficiency or stenosis of the mitral valve. Blood vessels may be blocked also by accumulation of white blood corpuscles in leukæmia. A simple mechanical plug produces the infarction. Infected matter breaks down the tissue in its vicinity, to constitute the metastatic abscess. Infarction is usually peripheral, cone-shaped, with the base at the pleura. The tissue is brown or black, firm, and distinctly separated from the sound tissue. The pleura maintains its lustre at first, but later becomes cloudy and covered with fibrin. Emboli usually come from the systemic veins, especially from the iliac and its branches, from the prostate and uterus, sometimes from lesions of valves in the right heart. The process is favored by retardation of circulation or heart disease. On account of paresis of the vessels from lack of nutrition the vessels become permeable, and blood fills the alveoli and bronchioles of the whole domain supplied by the occluded vessel—that is, the stasis leads to diapedesis. Conditions which produce sudden changes in the circulation may dislodge partially developed thrombi. Thus the accident has occurred after violent effort, the application or release of pressure, as chest corsets, bandages of varicose veins, laparotomy, emptying of cysts, etc. Metastatic abscess is found in connection with pyæmia, especially puerperal fever, ulcerative endocarditis, gangrene, furunculosis, etc.

Symptoms.—A small infarction may show no signs. Occlusion of a large branch of the pulmonary artery usually takes life at once. If the occlusion is not complete or the branch not so large, severe symptoms ensue—*extreme dyspnœa, syncope, convulsions, or coma.* Stress is to be laid upon the *loss of consciousness,* especially if associated with convulsions or preceded by dyspnœa or hæmoptysis. The *dyspnœa* is the most distressing sign; it becomes extreme, and is attended with the efforts and anxiety of despair; the heart's action becomes feeble, the pulse thready, the surface clammy with a cold sweat. The pleurisy gives rise to *severe pain;* there is *harassing cough and expectoration of dark, gelatinous, bloody mucus.* The sputum contains also peculiar large lymph cells, resembling alveolar cells, embodying blood corpuscles, sometimes as many as five or even more. These giant cells transform the blood corpuscles into pigment matter. They are seen especially in cases of heart disease, and are known as the cells of heart failure. Metastatic abscesses are accompanied by *chills* and the fever that belongs to pyæmia (puerperal, etc.). Physical examination reveals, as a rule, *moist râles, dulness to percussion, increased fremitus and resonance, bronchial respiration.* Partial occlusion of the

pulmonary artery develops a systolic murmur, with frémissement at the second left costal cartilage.

The *diagnosis* rests upon the sudden supervention of loss of consciousness, convulsions, dyspnœa, pain in the side, cough, bloody sputum, with the signs revealed by physical examination, in connection with the condition which might develop a thrombus or embolus.

The *prognosis* is always grave, but recovery is possible with the dissolution of the thrombus. Metastatic abscesses give the ominous outlook of pyæmia, but recovery is not impossible in these cases.

Treatment.—Inasmuch as the detachment or dissolution of the thrombus or embolus by artificial means is out of the question, treatment resolves itself into such disposition of the body as will favor the natural occurrence of these processes. Prophylaxis is of most importance. To discover the concealed disease, especially in connection with maladies of the uterus and prostate gland; to prevent, so far as may be, the formation of thrombi by antiseptic treatment of infectious disease; to secure the greatest possible rest, with immobilization of affected extremities, varicose veins, etc., exhaust the resources of therapy. Dyspnœa and pain demand the use of morphia subcutaneously.

ABSCESS OF THE LUNGS.

Abscess of the lungs is not an independent malady. Abscess develops in connection with tuberculosis as a vomica full of pus, detritus, micro-organisms, mould fungi, etc., or from the coalescence of smaller metastatic abscesses in the course of pyæmia. Abscess may result from pneumonia, especially catarrhal pneumonia, mixed infection, or trauma, including lesions of bronchi (foreign bodies).

Fig. 230.—Mould fungi from sputum of abscess of lungs.

The symptoms are those of the originating malady. The sputum is purulent, generally greenish, sometimes brownish as tinged with blood. It is made up chiefly of pus corpuscles with alveolar epithelium, elastic fibres and masses of lung tissue, detritus, crystals of margarin, cholesterin, hæmatoidin with blood pigment matter, phosphates, and various mould fungi and bacteria. The diagnosis may be established, with the aid of physical signs—dulness to percussion, in con-

nection with fever, usually remittent—by aspiration, a perfectly safe procedure with a perfectly clean instrument. When the diagnosis is established the abscess may be discharged by aspiration or incision. As most cases depend upon tuberculosis, the evacuation of the abscess does not cure the disease; in fact, an operation sometimes quickens its course. Where address is made at the same time to the cause of the disease by creosote, tuberculin, etc., the operation is justifiable. Abscesses from other cause (pneumonia, pyæmia) sometimes discharge themselves into the bronchi or pleural sac. Operation in all these cases may rescue the patient from the dangers of discharge into

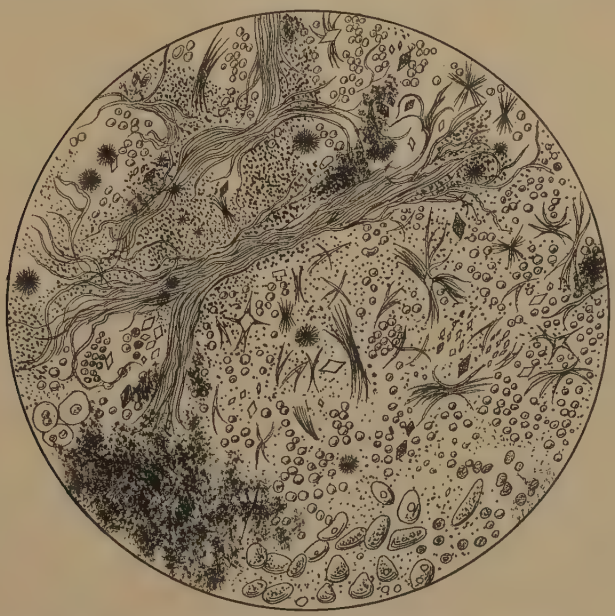


FIG. 231.—Sputum from abscess of lungs, showing elastic tissue, fat crystals, phosphates, epithelium, pigment matter, pus cells, and bacteria.

the pleura, pericardium, peritoneum, etc., as well as from the remoter evils of amyloid change and marasmus.

GANGRENE OF THE LUNGS.

Gangrene of the lungs is a rare condition. Primary gangrene, in consequence of trauma, with penetration from without of the organisms of decomposition, is very rare. The disease results rather more frequently from croupous and catarrhal pneumonia, infarction, neoplasms, cancer, echinococcus, actinomyces, abscess, and most infrequently from tuberculosis. Decomposing matter may be aspirated from the bronchial tubes into the air cells, especially in cases of sub-

jects suffering with coma or paralysis, alcoholism, old age, etc. The condition is twice as frequent in males, and occurs especially between the ages of twenty and fifty, the period of greatest exposure, and among the poorer classes.

Symptoms.—The gangrene may be circumscribed or diffuse, central or peripheral; it may reach and destroy the pleura and lead to pyopneumothorax. The disease is usually announced with *fever* from the absorption of putrid matter. The fever is attended with *chills and profuse sweats*, as in the case of pyæmia. The patient falls into a *typhoid state*, with delirium and coma. *Pain in the side* indicates a developing pleurisy. *The cough is usually dry, continuous, and harassing.* The characteristic sign is the *expectoration of putrid sputum.* The sputum is generally abundant, is often mixed with blood whose corpuscles are usually disintegrated. *The odor is excessively fetid and penetrating;* it fills the room or the large ward of a hospital, and may be perceived in adjoining rooms; it contaminates everything in contact with the patient. On standing it settles into three layers—an upper, frothy, greenish, purulent; a middle, greenish opaque; a lower, purulent, greasy, greenish mass, in which are found the characteristic grayish particles, plugs of the small bronchial tubes (the so-called Dittrich plugs), with detritus, fat globules, pus cells, and bacteria, mould fungi (leptothrix). The disease is distinguished from putrid bronchitis by the *presence of particles of disintegrated lung tissue*, grayish-black matter of irregular surface, *containing little or no elastic tissue*, which is supposed to be destroyed by a ferment something like trypsin. Sputum in general is sometimes so tough as to be teased thin with difficulty. In such case it should be diluted on the object glass with a solution of common salt 0.75 per cent, *not* with pure water. The following two solutions are used in the study of sputum: (1) dilute acetic acid 1 : 100 distilled water; (2) soda lye 3 : 100 distilled water. The one-per-cent solution best clears up fibrin and displays nuclei; the three-per-cent solution destroys the protoplasm, gradually also the nuclei, but distinctly displays elastic tissue and micro-organisms (Gräber).

The decubitus in gangrene is usually on the affected side; recumbent when the disease is situated in the upper lobes, semi-recumbent when in the lower lobes.

Circumscribed gangrene reveals no signs on physical examination. More extensive change shows the symptoms of consolidation —*dulness to percussion, bronchial or amphoric respiration, cracked-pot sound*, etc. Pleurisy, pneumothorax, and pyopneumothorax reveal themselves with their distinctive signs. Pyæmia with metastatic abscesses may ensue. The course is chronic. The

disease lasts, with remissions and exacerbations, from several months to several years.

The *diagnosis* depends chiefly upon the fetid sputum. Fetor from the mouth or nose is excluded by absence of disease of these organs; putrid bronchitis, by the presence of lung tissue. Simple abscess shows purulent sputum without offensive odor, containing abundant elastic fibres.

The *prognosis* is always grave, but depends upon the extent of the disease and the strength of the patient. Recovery is announced by the substitution of purulent sputum without offensive odor. Patients usually succumb to marasmus.

Treatment.—The condition may be prevented often by attention to the mouth in cases of paralysis, protracted infections, etc. The mouth is to be kept clean with borax, myrrh, thymol. Creolin, one per cent, makes a good mouth wash. The same attention is to be paid to the nose, into which boric-acid ointment gr. xv.–℥ i. unguenti petrolati may be insufflated. Traube recommended the acetate of lead, half a grain every two hours, especially in relief of hæmorrhage. *The sputum should always be received in water strongly impregnated with carbolic acid or lysol.* The best treatment consists in the administration of stimulants and expectorants, with the use of disinfectants, as already fully discussed in connection with putrid bronchitis. As expectorants, the best remedies are senega, benzoic acid, apomorphia; and as disinfectants, turpentine, thymol, pyridin, and myrtol. A good preparation of creosote in capsule, or with the tincture of nux vomica equal parts, administered with whiskey and water in equal parts, five drops of the creosote mixture to a tablespoonful or two of the whiskey and water, constitutes a fine expectorant, stimulant, and disinfectant, as well as a good stomachic tonic.

SYPHILIS OF THE LUNGS.

Syphilis of the lungs is rare and is usually congenital. It presents itself in the form of gummatous deposits of the size of a pea to a hazelnut, which subsequently undergo softening. A more common form, especially in the new-born, is the syphilitic pneumonia, which consists in a hyperplasia of the connective tissue, and leads to exuberation and desquamation of the epithelium. Nearly all the cases of so-called syphilis of the lungs in adults are cases of tuberculosis in syphilitic subjects.

CARCINOMA, SARCOMA, ECHINOCOCCUS OF THE LUNGS.

Carcinoma of the lungs is secondary, and depends upon metastases conveyed from some distant seat, usually by the lymph, or

results from extension by contiguity, as from the œsophagus, vertebra, mediastinum, pleura, etc. The right lung is affected more frequently than the left, the upper than the lower lobes. Cancer of the lung is more common in men, and occurs usually at an age earlier than cancer elsewhere. Primary cancer is very rare. It develops in these cases from the epithelium of the bronchial tubes. It has been most frequently observed in the Schneeberg cobalt mines, where it is attributed to the inhalation of arsenic in association with the cobalt, and where it is said to cause three-fourths of all deaths. It is usually medullary, and in metastatic form is commonly found in association with metastases elsewhere.

The signs of cancer of the lungs are for a time those of bronchitis. Sooner or later the sputum begins to be tinged with blood, not continuously but irregularly, and occasionally it assumes a peculiar raspberry-jelly appearance which is very characteristic. Rusty sputum occurs also, and sometimes a sharp hæmorrhage. The diagnosis can be definitely declared, however, only by the discovery of cancer tissue in masses accidentally dislodged.

Sarcoma of the lungs is even more rare than carcinoma. It has been observed in connection with lympho-sarcoma of the cervical glands, more frequently as a metastatic deposit in connection with osteo-sarcoma.

Echinococcus is usually found in connection with echinococcus of the liver, and may be suspected when cough, pain, dyspnœa, with the physical signs of consolidation, are found in cases of echinococcus of the liver. The *diagnosis* can be absolutely established only with the recognition of scolices, hooklets, etc., in the sputum.

The *treatment* of these conditions is wholly symptomatic or surgical.

PNEUMONOCONIOSIS.

Pneumonoconiosis (*πνεύμων*, lung, *κονία*, dust), the disease produced by inhalation of dusts in various avocations, used as a general term to include anthracosis, inhalation of coal dust; chalicosis, inhalation of lime and stone dust; siderosis, inhalation of iron dust, etc.

History.—The character of the coloring matter found in and on the surface of the lungs was long a matter of dispute. Pearson and Laennec expressed the suspicion that it was coal dust. Virchow considered it an organic pigment of internal formation. Traube (1860) first demonstrated the actual presence of coal dust in a miner's lungs, and Zenker showed the difference between this dust and organic pigment. Hirt, in his thorough studies, reached the conclusion that vegetable dust and mixed dust are much more intense irritants

to the mucous membrane of the respiratory tract than metallic, mineral, or animal dust.

Considerable accumulation of dust may occur in the lungs without damage. The body is protected against exposure by outside guards—hairs, moist surfaces which retain deposits, ciliæ—by cough, etc. A sound mucous membrane with perfect ciliary action gradually extrudes foreign particles. It is only when the quantity is in excess or is directly injurious, as in the case of gases, micro-organisms, etc., or, more especially, when the mucous membrane is affected with catarrh or other process which weakens ciliary action, that dust inhalations produce disease. Hence the mass of individuals exposed to the inhalation of dust escape disease. Disease produced by micro-organisms do not enter into consideration here. Occasional cases of disease from coal and stone dust occur among miners, chimney sweeps, foundrymen, stone and brick masons, plasterers, mill workers, glass and china factors, ivory grinders, lithographers; cases from inhalation of metallic dust, among the various iron smiths, copper smiths, etc.; cases from the inhalation of vegetable dust, among grain shovellers, cotton spinners, wood workers, millers, cigar makers, etc.

Symptoms.—The irritation produced by the inhalation of these dusts causes in certain cases at first acute and subsequently chronic bronchitis, which does not differ in any way, save by the presence of the various dusts, from bronchitis from other cause. Protracted bronchitis results in bronchiectasis, emphysema, hypertrophy and dilatation of the right ventricle, as in cases from other cause. The penetration of the bronchial tubes by foreign particles excites inflammation in the interstitial tissue, which results in the formation of small, hard nodules, constituting interstitial pneumonia. This affection is, however, rather suspected than recognized, on account of the obstinacy of symptoms. Inhalation of coal dust rather protects against than invites tuberculosis; vegetable dust favors the development of the disease.

The *diagnosis* is the recognition of bronchitis, more especially chronic bronchitis, which disappears with removal to a purer atmosphere, but recurs with renewed exposure. The various dusts disappear from the bronchial tubes, as a rule, in the course of ten to twelve days' stay in a purer atmosphere. Persistence in the sputum after this period indicates organic change in the bronchial mucous membrane. The nature of the dust may be known from the character of the avocation, or may be recognized in the sputum under the microscope. The addition of the ferrocyanide of potash to sputum boiled with hydrochloric acid, demonstrates the presence of iron by the formation of Prussian blue.

The *prognosis* is favorable under a proper hygiene. Factors in dusty atmospheres should be allowed hours of exercise in the fresh air. Better ventilation may be secured in the workrooms themselves.

The *treatment* does not differ from that of bronchitis from other cause.

PLEURISY.

Pleurisy (πλευρά, the side).—Infection of the pleura by the diplococcus, streptococcus, tubercle bacillus, etc.

History.—Paracentesis was performed even before the days of Hippocrates. Euryphon of Cnidos is said to have saved the life of Cinesias by opening the chest with the actual cautery. Hippocrates was thoroughly familiar with the operation. He even advised the very latest suggestion in therapy, to close the wound, after part of the pus was discharged, with a roll of linen to which a thread was attached, and to let off some of the matter every day. Hippocrates made use also of a zinc drainage tube. "If the pus is clean, white, or tinged with blood, the patient will recover. If it is thick, green, or ichorous, he will die."

Pleurisy was not separated from pneumonia in ancient times. There is reason for this failure in the fact that the diseases now are so often found associated. Sydenham, Morgagni, and Haller, with Boerhave and Van Swieten, all believed that the lungs were affected in this disease as much as the pleura itself. Pinel first gave pleurisy its distinct place, and Laennec, with the discovery of the friction sound, furnished the ability to distinguish the disease in life. The turning point in the treatment of pleurisy was reached in the discovery of the aspirator by Bowditch, of Boston, in 1852. The fact that pleurisy is never, strictly speaking, a primary malady, but occurs as the result of an infection which shows itself in some other organ, or is, at least, due to micro-organisms which produce diseases of other organs, is a matter of recent acquisition.

Etiology.—Pleurisy is looked upon in our day as an expression or localization of one of the infections. The pleura is the serous membrane most frequently invaded in the course of infectious diseases. The cause of pleurisy was formerly ascribed to trauma or taking cold; a penetrating wound from without, as a stab, or from within, as a rupture from a broken rib, or invasion from caries of the vertebræ, foreign body in the œsophagus, aneurism, etc. Any inflammation as the result of disease in a contiguous structure will produce inflammation of the pleura, but not that distinct form of disease which is set apart as a simple or distinct pleurisy. The difficulty of discovering the cause of pleurisy, the cause of inflammation in a structure so deep-seated and apparently secluded from all avenue

of ingress, led pathologists to adopt the view that pleurisy was an expression of tuberculosis. This view was fortified by the fact that the diseases were so often found associated, and that the subjects of pleurisy become not infrequently subsequently victims of tuberculosis. Further study has shown, however, that this cause applies only to the minority of cases, that most cases of pleurisy depend upon the invasion of other micro-organisms than the bacillus tuberculosis. Bacteriological studies of recent years, as by Netter and Levy, reveal the fact that most cases of pleurisy are due to the micro-organisms which produce pneumonia—the diplococcus of Fränkel and the pneumococcus of Friedländer. Netter shows that all forms of pleurisy are of microbic origin, but that the microbes producing them are of many different kinds. In one hundred and nine examinations of purulent pleurisy he found, in different cases, pneumococci, pyogenic streptococci, staphylococci, the bacillus tuberculosis, Friedländer's encapsulated bacillus, the pseudo-typhoid bacillus, Micrococcus tetragenus, spirilla, filaments of leptrothrix, and saprogenic bacteria.

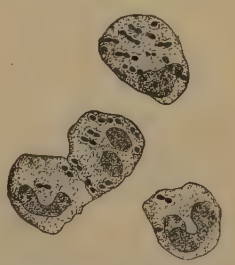


Fig. 232.—Micrococcus pneumoniæ crouposæ, showing capsules from exudate in pleural cavity of inoculated rabbit (Sternberg, after Salvioli).

The cases of simple serous effusion distinguish themselves often by negative evidence. These cases are called rheumatic and are attributed to the cause of rheumatism (Fiedler). In some of these cases, however, the diplococcus has been discovered as the evident cause of the disease. Cases secondary to Bright's disease are believed to owe their origin to chemical products, toxines, rather than to the direct presence of a micro-organism itself. Attempt has been made to declare the future of a case, whether it will remain serous or become purulent, by the character of the micro-organism encountered in fluid withdrawn for examination. Decisive results have not yet been reached. It is certain that the diplococcus of Fränkel is often found in cases which remain serous, and that the exclusive presence of this organism justifies a favorable prognosis. The pyogenic micro-organisms do not necessarily determine suppuration.

The rôle of exposure to cold in pleurisy is the same as that of the other infections. It may awaken a dormant process or localize an existing infection. As a rule "taking cold" expresses merely the onset and outbreak of a disease. In pyæmic processes the pleura is involved with the other serosæ; so pleurisy may occur in the course of puerperal fever, scarlatina, dysentery, rheumatism, etc., as a secondary process, sometimes as a terminal link in the chain of disease.

The pleurisy which apparently develops first is found to be produced, as stated, most frequently by the diplococcus or other microorganisms of pneumonia, so that pleurisy and pneumonia are associated as a rule. The pain in pneumonia belongs to pleurisy. It is a question rather which disease process predominates. It is possible to have a central pneumonia without a pleurisy, as it is possible to have a pleurisy without pneumonia. The rule is that pneumonia involves the pleura covering the affected lobe, and that pleurisy affects a peripheric zone of lung tissue. The secondary process subsides to leave the main inflammation dominant. Actual pleuritic effusion occurs in about five per cent of cases of pneumonia. When the pleurisy and pneumonia occur simultaneously the pleurisy is said to be parapneumonic; when the pleurisy follows the pneumonia it is said to be metapneumonic.

FIG. 233.—Limited expansion of chest on left side.

Forms of pleurisy are distinguished by the amount and character of the *effusion.* Cases in which the effusion is slight or absent are known as pleuritis sicca; cases with perceptible effusion as pleuritis humida, or pleurisy with effusion. The effusion is distinguished as serous or sero-fibrinous, purulent, sanguineous, or ichorous, according as it contains pure serum, fibrin, blood, or ichor. Forms are also separated into acute and chronic, and subvarieties of these forms into those which develop with the most intense symptoms, pleuritis acutissima, and those which develop so insidiously as to have remained latent for a long time. Most of these last cases belong to tuberculosis.

Symptoms.—Pleuritis begins as an acute infection—*i.e.*, with a *chill* or a series of shivering fits attended with rise of temperature. The fever is quickly followed by *pain.* The pain is usually pretty strictly circumscribed and is localized in the region of the left nipple. The pain is manifest in places where the layers of the pleura are subject to most friction. The base and apices of the lungs remain at comparative rest. The sides are subject to most motion. The pain is present in every degree of intensity. The distinctive pain of pleurisy is usually acute. It stops the movements of the chest and checks the act of respiration. Respiration becomes chiefly abdominal. The patient learns to spare the chest, sometimes to *limit the excursion* of the affected side. There is, however, along with the pain of pleurisy, *no increase in the frequency of respiration,* so characteristic of pneumonia. The patient can take a long breath. It is plain to

see that the inhibition of respiration is not a matter of inability or incapacity, but of pain. The patient *lies on the sound side* in relief of pressure on the affected side. Later, when effusion takes place, the patient changes posture to *lie on the affected side*, that the sound side may expand to secure more full inspiration. With the pain there is *cough*, dependent upon irritation of the pleura. That cough may result from direct irritation of the pleura is a fact with which clinicians may become familiar in the treatment of this disease. It may become necessary to remove a drainage tube in relief of a cough so harassing as to prevent sleep. *Expectoration is absent*, scanty, or purely bronchial. The disease is said to exist now in its first stage. At this time *inspection* reveals only limitation in the movements of the chest. Percussion gives no sign. Auscultation reveals *the friction sound*, a fine subcrepitant râle, striking on account of its superficiality, and circumscribed about the region affected. In a simple pleurisy the friction sound is transitory. It may be present for but a few hours or a day. It disappears under adhesion, effusion, or resolution. It may return with the reabsorption of fluid, which renews contact of inflamed and roughened surfaces.

With the second stage of the disease, *the stage of effusion*, the physical signs change. When the effusion is very rapid, inspection will show more distinct interference with respiration. The *breathing is increased* in frequency. The *pulse becomes irregular* from interference with the circulation by pressure upon the great vessels. Some *cyanosis* may show itself. Where the effusion is great the *affected side of the chest may bulge*, the intercostal spaces become more prominent. The abdomen itself protrudes from depression of the diaphragm by the weight of the effused fluid. It is observed that the *apex of the heart is displaced* toward the right if the effusion be on the left side, toward the left if on the right side. Slight displacement of the apex of the heart to the right is observed before the accumulation is so great as to account for it by mechanical displacement. It is attributed to the altered resiliency of the lung on the affected side. The accumulation of fluid may be followed up by percussion. Change of posture reveals the fact that the fluid is free. *It floats about as determined by gravity.* The dulness in the back becomes resonance by placing the patient on the face, etc. Finally, the lung is compressed as an airless cake against the spinal column.

Auscultation reveals nothing. But *muffling or entire absence of sound* is testimony more valuable than sound itself. In the region of the compressed lung, particularly between the scapula and the spine, *bronchial respiration* is audible and bronchophony is distinct. Finally, *fremitus and resonance are both either diminished or absent* over the affected lung. A peculiar tremulous note, known

as *ægophony*, may be heard just above the level of the fluid. It is produced, not by the fluid itself, but by laxity of the lung tissue. Baccelli claimed that a whisper could be heard through a clear fluid, but not through a fluid rendered turbid by pus. Rumino believes this sign to be reliable—an opinion to which most clinicians fail to subscribe.

Usually *the fluid is serous or sero-fibrinous.* It is not uncommonly *purulent.* It is a question if the effusion is purulent from the start. It may certainly become purulent in the course of a very few days. *The change is usually indicated by increase of the fever.* The temperature, which may have been before but 100° to 102°, now rises to 103° or 104°, especially in the evening. The patient loses appetite and strength, becomes restless and sleepless. These symptoms often signify the change to pus. Very frequently the change is so gradual as to be unannounced. The clearest serum contains a corpuscular element. Aspiration observations reveal the fact that a fluid clear at first becomes often milky toward the close. Corpuscles sink by their weight to occupy the lower strata. In most cases the character of the fluid can be determined only by withdrawal through an aspirator or a *clean* hypodermatic syringe. Cases due to advanced tuberculosis, as to irruption of a vomica into the pleural sac to constitute pneumothorax, often show ichor. Where the effusion contains blood the disease is usually either tuberculosis or cancer. There is in these cases corresponding cachexia and degradation. It is by no means always easy to distinguish the kind of fluid in the chest by the physical signs. Aspiration makes the diagnosis easy. Puncture with a perfectly clean instrument under aseptic precautions, which consist merely in washing the skin with soap and a sublimate solution 1 : 1000, is always justifiable in an obscure case. Failure to withdraw fluid does not necessarily exclude pleurisy. The case may be a pleuritis sicca, or effusion may have been absorbed to leave thick membranes. The needle sometimes becomes plugged with a flake of fibrin ; hence the aspirator, with its great suction force, is to be preferred to the hypodermatic syringe.

The *diagnosis* is determined by the pain in the side, the fever, decubitus, limited respiration, friction sound, and signs of effusion. The effusion is itself diagnosticated absolutely only by puncture with the hypodermatic needle or aspirator.

Pneumonia is distinguished by higher fever, cough, expectoration of rusty sputum, crepitation, dulness to percussion unvaried by posture, bronchial respiration, etc.

Hydrothorax is separated by its cause, heart disease, kidney disease, etc. It is bilateral, painless, free of fever, and furnishes to puncture a clear, light-yellow fluid, free of flocculi, of light specific gravity, less than 1018.

The *prognosis* depends upon the cause. Simple pleurisy has a favorable prognosis. Tubercular pleurisy is always grave, yet cases do recover absolutely.

It is essential to distinguish the form of the disease, as the *treatment* depends upon it. Simple cases are let alone. The case is treated on the expectant plan, or, with the doctrine of rheumatic origin, by the salicylates, precisely as in acute rheumatism. Fiedler stoutly claims that early treatment with the salicylates aborts the disease. Pain is relieved by hot applications—*i.e.*, hot water—investing the whole side of the chest. More severe pains may require broken doses of Dover's powder gr. ij.–vj., or morphia itself gr. $\frac{1}{8}$–$\frac{1}{4}$. Under rest and relief of pain the fluid is absorbed spontaneously. Cases of pneumonic or tuberculous origin, unduly protracted cases of any kind, and all cases of pleuritis acutissima, demand aspiration of the effusion. Nature should be first allowed a chance for two or three weeks. Persistent fever, progressive failure in health and strength, weight and color and appetite, command the operation. The puncture should be made in the fourth left, fifth right intercostal space, and the fluid slowly but never wholly withdrawn.

EMPYEMA.

Empyema (*ἐμπύημα*, an internal suppuration); suppurative pleurisy.—The fluid effused in pleurisy, though it may seem perfectly clear, always contains corpuscular elements. These elements may be so few as to escape observation altogether. As the case progresses, more especially after frequent paracentesis, the corpuscles accumulate, until finally the fluid becomes milky and the serum is said to be converted into pus. It is a frequent observation that, though the fluid may be clear at first, it later becomes more opaque. The first syringefuls may be clear serum, the last purulent. This change may take place rapidly or slowly; sometimes the fluid is purulent from the start. This condition occurs more frequently than is commonly believed. Most of the cases of secondary pleurisy, as in the course of pyæmia, after violent dysentery, etc., are purulent from the start. This form of pleurisy is known by a different name—*empyema*. It has a different prognosis and requires a different treatment. The character of the fluid is determined by the primary or superadded cause of the disease. The organisms most frequently encountered are the streptococcus, staphylococcus, pneumococcus, diplococcus, and tubercle bacillus.

Certain *symptoms* may indicate the period of accumulation or formation of pus. Fever shows itself, or increases if present before. It is especially wont to *assume a remittent type* with exacerba-

tions at night. The patient loses what appetite he had, becomes restless, sleepless, suffers pain. It is plain to see that he is losing ground. Frequently the change takes place so insidiously as to escape notice. Sometimes the disease is perfectly latent, or, if decline be noticed, the diagnosis is dubbed tuberculosis and dumped into the heap of so-called incurable diseases. Empyema is in general much more common in childhood. Empyema is an internal abscess. Pus may not remain with impunity within the cavity of the chest. The pus of empyema has special erosive properties and may cut its way to the surface. In these cases it generally perforates at the thinnest place, near the sternum. It perforates the parietal layer, insinuates itself between fibres of the intercostal muscles, and appears as a subcutaneous abscess, where it shows itself in surface redness and œdema. When the track of perforation is straight the outside abscess is seen to expand and contract under movements of expiration and inspiration. Sometimes it conveys the impulse of the action of the heart. Ordinarily the track is more oblique and irregular, to form a kind of valve which permits only the escape of fluid accumulated within; or the surface may be more directly perforated, sometimes by a number of orifices, to permit rapid escape, or, more frequently, the long-continued oozing out, of pus. Such a case is an "empyema necessitatis."

FIG. 234.—Tyrosin in needle-shaped crystals arranged in bundles and stellate groups.

In other cases the pus penetrates inwardly; it attacks and erodes the visceral pleura. The lung may now take it up and like a sponge become saturated with pus, or, more frequently, the bronchus is invaded and the contents of the pleural sac are poured into the bronchial tubes to issue in quantities from the mouth. An empyema may empty itself in this way. The pleural sac may thus become obliterated, or reaccumulation occurs with renewed discharge. Such patients who discharge with bronchial cough, at intervals, large quantities of pus, are often regarded as tuberculous.

The sputum in these cases is distinguished by the presence of crystals of leucin and tyrosin. Leucin occurs as globular masses, tyrosin as needle-shaped crystals peculiarly arranged in bundles. These bodies are degenerated products of albuminoid bodies developed in pus under exclusion of air. Hence they may be regularly encountered in a perforating empyema. But they are usually pre-

sent in solution, and may be seen, therefore, only when the sputum dries, as they are deposited in characteristic form about the border of the object glass. Leucin looks like fat globules, but is distinguished by its insolubility in ether (Gräber).

The discharge through the bronchial tubes is the most favorable event which may occur spontaneously in the history of empyema. In rarer cases pus may penetrate the diaphragm and insinuate itself along the spine behind the peritoneum, to appear as an abscess at the groin on the inner aspect of the thigh, where it may be mistaken for a sinking abscess from vertebral caries. As curiosities may be mentioned cases in which pus breaks directly into the pericardium or peritoneum, or by fistulæ into the perineum, etc.

Treatment.—Cases of pleuritis acutissima call for immediate relief to prevent suffocation. In these cases pain is intense, dyspnœa is pronounced, the pulse is excessively weak, collapse is imminent. Weil collected seventy-five cases of sudden death in the course of acute pleurisy, due to compression of blood vessels, pulmonary thrombosis, and heart failure.

How long fluid may be permitted to remain in the chest is a question that must be decided in the individual case. Where the patient is doing well, as determined by the pulse, respiration, and general appearance, the case may be let alone. Spontaneous absorption, even of pus, is the rule in childhood. Should, however, great change be noticed in any way, the fluid should be withdrawn, and in no case should it remain longer than two to three weeks for fear of compression of the lung. Paracentesis is best performed by aspiration with a needle, whose cleanliness is secured by having been boiled five minutes. The surface is rendered aseptic with a 1 : 1000 sublimate solution, having been first cleaned with soap and water. The needle is then plunged between the ribs in the axillary line at the fifth, sixth, or seventh intercostal space, near the upper border of the lower rib, to prevent wounding an artery or nerve. Where the fluid is known to be a pure serum the finest needle may be employed. When a previous aspiration has revealed the fact that the fluid is thick or contains flakes, a larger needle must be used. The presence of fluid is usually discovered at once with the first attempt, but accumulation or thick membranes may require repeated puncture. The fluid is in no case to be withdrawn wholly. The operation should be checked at once upon the supervention of any irregularity in the action of the heart, pulse, respiration, or severe cough. The face should be as closely watched for any sign of syncope and the chest for any evidence of dyspnœa as in the inhalation of chloroform. Sudden death has occurred from heart failure, from thrombosis, or from sudden obstruction of the air cells. The fluid is

withdrawn slowly, that the lung may follow it in expansion, or that, where this is impossible, the chest may undergo retraction. With these precautions the operation is simple and safe. A large accumulation of fluid may necessitate rapid operation. Empyema in a child may terminate, as stated, of itself, and hence should be allowed to run a little longer. In adults the operation is made at once. The patient is put in a semi-recumbent posture, inclined toward the opposite sound side to separate as much as possible the imbricated ribs. A piece of skin is pinched up between the fingers, transfixed, and severed by a bistoury from below upward. A subcutaneous injection of the solution of cocaine may substitute an anæsthetic. The rib may or may not require resection—always a simple, but for the most part a superfluous, procedure. The knife is then plunged into the pleural sac. Pus usually spurts out in quantity with much gurgling and sound of insufflation, which speedily subsides to give place to a profuse discharge. A perforated tube is now inserted, or, better, a roll of iodoform gauze, and the case, with cleanliness, may be left to itself. Irrigation is no longer considered necessary.

PNEUMOTHORAX.

Air may penetrate to the pleural sac from without, as through penetrating wounds, or from within after rupture of the visceral pleura, to constitute pneumothorax. In more than three-fourths of cases the condition is caused by tuberculosis of the lungs and represents irruption from a cavity. In exceptional cases pneumothorax may result from empyema or from abscess or gangrene of the lungs; still more rarely from disease of the œsophagus, stomach (gastric ulcer), or intestine. As a rule the connection with the lungs subsequently closes and the enclosed matter, air, serum, blood, or pus, becomes encapsulated. Sometimes it remains open or is closed by a valve.

In consequence of the connection with phthisis, pneumothorax occurs twice as frequently on the left side, and is found oftenest in the acute or subacute cases with rapid advance. Double pneumothorax is extremely rare.

Symptoms.—The condition is usually announced suddenly; sometimes after effort, muscular strain, or cough; with *intense pain, anxiety, and extreme dyspnœa, cyanosis, and heart failure*, to constitute a picture of deep distress. Collapse of the lung, with displacement downward of the diaphragm and abdominal organs, are direct results of pressure. The heart's action is barely perceptible, the pulse is reduced to a thread. *Œdema of the hand of the affected side is a striking symptom* which stamps the character of the affection in certain cases; when it occurs it shows itself early, and, as

a rule, rapidly disappears (Weil). After empyema *pus may be expectorated.* Inspection reveals *distention*, sometimes surface emphysema. *The heart's apex is displaced* downward, and to the right in left-side affections, to the left in right-side affections. *Resonance and fremitus are diminished or lost.* Percussion shows *tympanites*, which is diminished under extreme distention, with low dulness over the displaced liver and spleen. Nothing is to be heard under auscultation. The vesicular râle is suppressed. Various cavernous, amphoric, metallic sounds are sometimes to be heard somewhere or over various parts of the chest. Auscultation during percussion appreciates metallic sounds. The presence of fluid in the cavity of the chest substitutes dulness for resonance or tympanites. The dropping of fluid may be recognized sometimes as *metallic tinkling*, or the play of air through valve openings and fistulæ, "water-pipe" sounds, are more or less distinctly audible. Agitation of the body may furnish splashing sounds—*succussion.*

The *prognosis* is always grave, but depends upon the cause, more especially upon the extent or advance of the phthisis. While the patient may sink into a fatal collapse in the attack, he may nevertheless recover from aggravated forms. According to West seventy-five per cent of cases succumb within fourteen days, ninety per cent within a month.

Treatment.—Pain must be relieved by morphia and hot applications; large flannels wrung out of excessively hot water may surround and envelop the whole of the affected chest. The pain, dyspnœa, and anxiety of extreme distention may necessitate paracentesis with an aspirator needle or a fine trocar. The strength must be sustained with stimulants—alcohol; soda benzoate of caffeine three grains every hour, internally or subcutaneously; digitalis. Witzel recommends the displacement of the noxious matters in the chest by the injection of the sterilized physiological solution of common salt.

HYDROTHORAX.

Fluid, serum, is effused into the cavity of the chest in consequence chiefly of heart and kidney disease, and the condition is an expression of general dropsy. Effusion takes place in slighter amount in consequence of marasmus, compression of the great lymph or blood vessels, thoracic duct, intrathoracic veins, as by aneurism, tumors of the mediastinum, etc. The effusion is usually passive and bilateral, and is found in connection with anasarca, ascites, sometimes with œdema of the lungs, etc. The fluid is clear, yellowish, often with a greenish tinge, alkaline, free of flocculi. The specific gravity is light, 1010–1012.

The *diagnosis* rests upon the recognition of the cause, more

especially upon the physical signs, which do not differ from those of pleurisy with effusion, save that the effusion in hydrothorax is bilateral. *In all cases of doubt the diagnosis is determined by aspiration.*

The *prognosis* and *treatment* depend upon the cause. Excessive dropsy, with the danger of asphyxia, is relieved by caffeine, digitalis, diuretin, especially by calomel, as in the treatment of heart disease. It is sometimes necessary to drain the legs.

HÆMATOTHORAX.

Hæmatothorax, as the name indicates, is the presence of blood in the pleural sac, as the result sometimes of penetrating wounds, or of fracture of a rib with rupture of an intercostal artery ; much more frequently of discharge from a cavity with eroded blood vessels, in tuberculosis. The blood in these cases is usually mixed with pus, sometimes also with air or gases, to constitute a pyohæmatothorax or a pneumopyohæmatothorax. The condition is not to be confounded with the bloody effusions of tuberculous or cancerous pleurisy.

Prognosis.—The blood from a penetrating wound may be absorbed and the patient may recover. The prognosis after rupture of an aneurism is fatal ; the patient succumbs to internal hæmorrhage. The prognosis in cases of tuberculosis, where the condition is associated with pyothorax or pneumothorax, is exceedingly grave.

The *treatment* does not differ from that of pneumo- or hydrothorax. It must have reference to the cause—tuberculosis, aneurism, etc.

PERIPLEURITIC ABSCESS.

Peripleuritic abscess is a rare condition, first recognized by Wunderlich, afterward more thoroughly described by Bartels, which results most frequently from the invasion of actinomyces, but may arise independently from unknown cause. Peripleuritic abscess gives rise to symptoms which have led to confusion with pleuritic effusions, empyema, in that both affections distend the chest. A point of differentiation is the fact that the ribs are separated, in abscess, at the seat of the greatest accumulation of pus, while they are crowded together in other regions, whereas in empyema the distention and separation are uniform. The intercostal spaces, or abscess wall, retract or become lax on inspiration and tense on expiration, whereas they remain unaffected in empyema. There may be fluctuation in abscess, absent in empyema. The abdominal organs are displaced in abscess; the pus itself has a lighter specific gravity, maximum 1032 in empyema, minimum 1040 in abscess.

Treatment consists in the discharge of the abscess.

SUBPHRENIC ABSCESS.

Abscess below the diaphragm, the result of ulcer of the stomach, disease of the liver, upward wandering paranephritic or peri- or paratyphlitic abscess, or the result of empyemata whose products have been carried by lymph vessels through the diaphragm, etc., forms collections above the liver or spleen, sometimes of considerable magnitude. The diagnosis is established, in connection with the previous history, by means of the aspirator. Treatment is the discharge of the pus or other surgical intervention.

DISEASES OF THE ORGANS OF CIRCULATION.

CHAPTER VII.

DISEASES OF THE HEART.

PERICARDITIS.

Pericarditis.—Infection of the pericardium in the course of some mycosis or inflammation by extension of disease from some contiguous viscus.

History.—The ancients considered hairy hearts (fibrinous deposits) evidence of courage. The earlier anatomists could not fail to find the evidence of pericarditis in effusion. Galen saw it in animals and suspected it in men. Rondelet recognized it under the symptoms of pain, difficulty of breathing, and fever, with attacks of fainting. Riolan went so far as to suggest withdrawal of the fluid in cases of effusion, and described the symptoms as being more dangerous than those of pleurisy or pneumonia. Vieussens relates that he often encountered adhesion of the two layers of the pericardium. There was as yet, however, not sufficient knowledge to enable a diagnosis to be clearly established in life. Morgagni declared that the day was distant when the ability to recognize the disease would justify the operation of puncture of the pericardium. Avenbrugger noticed bulging of the præcordium and increase of percussion dulness. How little these discoveries contributed to a diagnosis may be learned by the fact that even Laennec (1819) doubted the possibility of making an accurate diagnosis. Collin (1824) discovered the friction sound, which at once made the recognition of the disease general property. Later contributions have more to do with the etiology of the affection.

The *frequency* of occurrence of pericarditis is best shown by statistics from hospital practice, where accurate records are kept and full autopsies are held in all fatal cases. According to the report of one year, 23,249 cases of disease of all kinds were treated in

the General Hospital in Vienna. Of this number 551, about one-fortieth of the whole number, were cases of rheumatism. However, but 390, about one-sixtieth, were cases of rheumatism of the joints. Pericarditis occurred 32 times, or once in every 726 cases of disease of all kinds. The point of especial interest is the fact that the pericarditis was a sequel or consequence of rheumatism in but 6 cases, while in 26 cases—that is, five times as often—the disease depended upon other causes. Endocarditis on this occasion occurred but 15 times. Pericarditis was, therefore, in that year twice as frequent as endocarditis. This ratio may have been an accident, or it may be that endocarditis only seems more frequent because it leaves valvular lesions. Patients recover or die of pericarditis quickly, as a rule. Cases do not accumulate as in endocarditis. The older statistics, based simply upon clinical observation, speak for the greater frequency of endocarditis. Thus Sibson's record shows three times as many cases of endocarditis. But clinical observations can give no precise information regarding the frequency of pericarditis, for the very reason that the disease, so often latent, is overlooked.

Fig. 235.—Cor villosum. Fibrinous pericarditis.

Exact information in this respect can come only from the dead-room. Duchek claims to have found evidences of pericarditis 89 times in 590 post-mortem examinations—that is, in a fraction over fifteen per cent of all the autopsies made—but this ratio must be regarded as an overestimate, for the reason that Duchek included in his diagnosis the cases of so-called milk spots, which are now no longer regarded as pericarditis. But, with due allowance for the tendinous spots, which are especially frequent in age, when true pericarditis is especially infrequent, it is seen that pericarditis is a comparatively frequent disease. Perhaps the statement of Willigk that pericarditis is encountered in four per cent of autopsies is nearer the truth, in that this statement is based upon observations made during the earlier periods of life. Later observations only serve to confirm the statement of Bauer to the effect that "formerly, and up to the close of the last century, pericarditis was considered a rare disease; since then it has been proved to be of quite frequent occurrence."

Etiology.—It is universally conceded that pericarditis occurs

oftener among males than females. Of the thirty-two cases cited from the Vienna hospital, twenty-three were males. Louis says of his one hundred and six cases that only one-fourth were females, a ratio which agrees with the observation of Hache. Bamberger's ratio was thirty-eight males, twenty-five females. Sibson, who saw the largest proportion of females of any author, observed nevertheless the preponderance of males; of his sixty-three cases, thirty-five were males, twenty-eight females. This ratio points to the greater liability of males to the diseases which cause pericarditis.

Excluding the cases of so-called tendinous spots, which are now regarded as simple friction scleroses or hyperplasiæ of senescence, it is as generally admitted that pericarditis is a disease of youth and maturity. Grisolle and Bamberger unite in the statement that the maximum frequency of the disease occurs between the ages of twenty and thirty.

The relation of occupation to pericarditis has been best shown by Sibson, who observes that "servants formed fully two-thirds of the whole of the female patients affected with pericarditis." It is interesting to note of Sibson's cases that pericarditis occurred in none of his females of sedentary occupation, needlewomen, etc. The influence of hard work is still further proven in the study of his male cases.

Pericarditis is described as primary and secondary in its nature, and much confusion exists as to what is meant by primary pericarditis. If by primary is meant a spontaneous or autochthonous inflammation, the term should be discarded altogether, for it may be said that pericarditis never arises in this way. Pericarditis is, strictly speaking, always a secondary or deuteropathic malady. There are met, it is true, occasional cases where the cause has not been or cannot be discovered, but these cases should be labelled inexplicable or cryptogenetic rather than primary. All modern writers agree as to the great rarity of so-called primary pericarditis. Duchek saw only one case in eighty-nine, Bamberger but four in sixty-three. Friedreich, with his wide experience, met but two cases in which he could discover no cause for the disease. Since the field of "catching cold" is being daily more and more contracted in the etiology of disease, it is wiser to be agnostic regarding inexplicable cases than to appeal to doctrines incapable of demonstration and hence bound to become obsolete.

An etiological division of cases more in accord with existing knowledge would be into *consecutive* (or mechanical) and *infectious* (or mycotic). Under the head of consecutive origin would fall the cases of insult or injury to the pericardium from without, as by traumata, by perforation from a gastric ulcer, from the œsophagus,

from an abscess of the spleen, from pulmonary and pleuritic processes, echinococci, aneurisms, caries of the vertebræ, sternum, and ribs, mediastinal affections, inflammations of the mammæ, skin diseases—in short, all involvements of the pericardium by contiguity or continuity of structure, including under this head also extensions of inflammation from the heart itself.

While these cases of so-called mechanical origin form a respectable contingent of all the cases, they nevertheless remain in the minority, all combined, when compared with the inflammations or processes secondary to the infectious diseases.

The pericardium is not alike affected by all infections. Certain forms of them show distinct predilection for this structure, and so notoriously is this true of *acute articular rheumatism* as to lead many practitioners to exclude pericarditis in its absence. It is undoubtedly true that acute joint rheumatism remains the most prominent factor in the etiology of pericarditis, that it causes, or is attended with, more cases than any other one factor—Bamberger claims that thirty per cent, Chambers and Thompson sixteen and twenty per cent, of cases arise from rheumatism—but it is equally true that there is no other acute infection which may not be followed by pericarditis.

If pericarditis is to occur in rheumatism it shows itself by preference between the fourth and fourteenth days of the disease.

While it is always a possibility in mild, brief, or protracted cases, the rheumatisms marked by severity or fugacity are rather more liable to entail pericarditis. With endocarditis it occurs far more frequently in the young.

Next in frequency in the pathogeny of pericarditis comes pleurisy. Morgagni and Corvisart remarked this complication in their day. Duchek claims to have seen in forty-three cases of fresh pericarditis an associate pleurisy twenty-two times; but, inasmuch as the freshness or age of the pleurisy is not remarked, it is fair to infer that the order of sequence, in some of the cases at least, may have been reversed. In Bamberger's cases of pericarditis 10.5 per cent arose from pleurisy and pneumonia.

Tuberculosis affects the pericardium in both ways. That is, the process may by contiguity inflame, or a vomica open up, the pericardium, to produce the disease in a mechanical way. Or the microorganisms of tuberculosis may lodge and multiply upon the serous surface, just as upon the cerebral meninges or tunica vaginalis, as conveyed thither in the lymph and blood supply. Bamberger's statistics show pericarditis in fourteen per cent of cases of pulmonary phthisis, but it is impossible to eliminate the rôle of pleurisy in any of these cases.

Statistics are wanting declaring the relative frequency of pericarditis in the various acute infections, yet it is known of nearly all of them that this complication does occur.

In pyæmia and septicæmia, as typically represented in traumata, puerperal fever, and prostatitis, pericarditis with its frequent associate, endocarditis, is the complication which directly or indirectly is the most frequent immediate cause of death. It occurs in all three forms of typhus—the exanthematic, recurrent, but most rarely in the abdominal form. Measles, scarlet fever, and small-pox are attended with pericarditis occasionally only in the less severe, as a rule in the malignant, forms of these diseases. It is not very rare in cholera, and is quite common in epidemic dysentery, along with, or independent of, the rheumatism which sometimes follows dysentery. In erysipelas, diphtheria, cerebro-spinal meningitis, pericarditis not infrequently constitutes the last link in the chain of disease process. These are all diseases of mycotic origin.

But pericarditis may ensue upon even the lightest infections. Perhaps the most interesting illustrations of this fact are those of Bednar, who several times observed pericarditis after vaccination. In one case an acute dermatitis developed in twenty-four hours after vaccination, with a simultaneous pericarditis. In a second case—a sharp diarrhœa—subcutaneous abscesses and pericarditis proved the order of sequence. In a third case the pericarditis developed on the thirteenth day after vaccination, without intervening disease.

In Bednar's thirty-six cases of pericarditis the disease was found independent of other demonstrable lesions only four times. Thirty of these cases occurred within the first month of life, four in the second, and one in the third and fourth months. In all cases the disease was attributable to puerperal processes in the mother, which, in the author's words, "extended their injurious effects to the child, and, in consequence of acute decomposition of the blood, developed fibrinous or purulent exudations in various organs and frequently in the pericardium. The disease proved fatal, as a rule, within the first sixteen days of life."

Pericarditis shows itself in *forms* distinguished as primary and secondary, and acute and chronic; but the forms of practical interest are those attended or not with effusion.

Symptoms.—Few of the signs upon which the recognition of the disease is based are local. The disease is generally recognized by general signs. Pain is not a prominent factor in the history of pericarditis. It may be present as a more or less diffuse distress, but is manifest rather upon pressure than spontaneously.

On account of disturbance in the action of the heart itself there is

often *precordial anxiety,* as manifest in the physiognomy of the patient. Pericarditis sicca runs, as a rule, a latent and unsuspected course, and the diagnosis is only established by auscultation. The *friction sound* may often be heard anywhere over the heart, most intensely over the body of the heart at the left border of the sternum. In simple pericarditis from rheumatic cause it is often very transitory and may exist during the space of but a few hours. The earlier writers described it as a *to-and-fro sound,* corresponding with the contraction and dilatation of the ventricles. While it is therefore a double sound, *it is not strictly synchronous with the sounds of the heart.* It may change or disappear by change of posture, by pressure of the stethoscope, and is often intensified by the act of holding the breath. It varies in every degree of intensity from a whisper to the creaking of new leather, and seems to be, as compared with heart murmurs, *exceedingly superficial,* as if just under the ear. It disappears naturally (1) in the process of *resolution,* (2) with the separation of the membrane by *effusion,* and (3) with *adhesion* of apposed surfaces.

In pericarditis from tuberculosis or from mechanical cause the surface is wont to be much more roughened and the sound coarser and more persistent. Having disappeared under effusion, it may return as a "redux rub" after absorption of the fluid.

Pericarditis with effusion is much more readily recognized. In slight amount up to a few ounces the effusion may escape detection. Not infrequently the first sign of effusion is interruption of the friction sound. As a rule effusion reveals itself by the general disturbance in circulation and respiration. Where the process is slow, tolerance is established and effusion is arrested in the course of a few hours or a few days at a point which does not materially interfere with the action of the heart. The fluid may now be absorbed and the disease disappear without having even been recognized in life. The effusion is, however, more wont to become persistent or permanent in the pericardium than in the pleura, and under any greater accumulation signs of general distress more or less rapidly supervene. The heart's action becomes weaker, the pulse is feebler. There is *pallor, with prostration, dyspnœa, sometimes cyanosis and syncope.*

A case strikingly illustrative of these points occurred in the experience of the author. The patient had been the victim of unsuspected pericarditis with effusion for fifteen years—at least the same symptoms had been present in greater or less degree all that time. The prominent symptoms were pallor, dyspnœa, such vertigo as to compel the recumbent position, occasional cough, and a pulse so feeble as to fade away when the arm was held at right angles to the body.

Digitalis and alcohol administered from time to time obviated imminent collapse. There was undoubted increase of dulness over the region of the heart, which had been taken for dilatation. By aspiration one pound of serum, at first clear, later brownish and flocculent, was withdrawn from the pericardium. The symptoms of immediate danger soon disappeared. But the long pressure and maceration had weakened the walls of the heart to such an extent as to prevent perfect recovery.

Fig. 236.—Pericardial effusion with displacement downward of the liver.

The diagnosis in these cases is established for the most part by the physical signs. Inspection shows, in the chest of the young, bulging, and palpation reveals muffling or absence of the impulse of the heart. The to-and-fro friction sound is characteristic. The most valuable signs are disclosed to percussion. There is *dulness* over the entire præcordium, corresponding to the distended pericardial sac. When this dulness is outlined upon the surface of the chest it is seen to constitute a *truncated cone*, whose base is at the diaphragm and whose truncated apex corresponds to the attachment of the pericardium about the great vessels. Fluid accumulates usually to the extent of a pint or more, and such accumulation gives rise to distinct dulness over the whole left front of the chest. In the absence of tuberculosis or apex pneumonia, dulness under the clavicles, beginning at the second or third rib and extending downward and outward, should always excite suspicion of pericardial effusion. Occasionally the accumulation is so great as to conceal a great part or the whole of the lung which it oppresses by its weight.

Andral once discovered two pounds of blood, Corvisart once found eight pounds of serum, and Alonzo Clark reported the history of a case where the pericardium contained one gallon of sero-purulent fluid. The distention which the sac must undergo to accommodate such quantities becomes evident with the statement of the normal capacity, fourteen to twenty-two ounces in the adult male.

The mental disturbances which have been described in connection with pericarditis are due either to interference with the circulation of the blood in the brain, or are toxic effects in connection with the original and originating maladies. With the history of a mycosis, the previous occurrence of the friction sound, and the presence of dulness, the diagnosis is very simple, and failures in recognition of the diseases are due here, as well as elsewhere, to lack of examination.

Diagnosis.—The disease must be differentiated at times from *pleurisy.* Pleuritic friction sound corresponds to the acts of respiration, and is arrested when the patient holds his breath. In rare cases the pleura may be rubbed by the action of the heart. The diagnosis must be established, if the diseases are not associated, by a consideration of the other signs. Endocardial murmurs distinguish themselves from pericarditic friction sound by the fact that they are more strictly synchronous with the sounds of the heart. They are more uniform in intensity and are not affected by change of posture or pressure. They may be rendered more intense by exercise. Doubt regarding the nature of the effusion may be dispelled by puncture with the hypodermatic syringe. The needle should be introduced at the fourth, fifth, or sixth intercostal space, half an inch or an inch to the left of the sternum. Failure to secure fluid does not necessarily exclude its presence. The tube may be blocked by a flake of fibrin, or the fluid may be too thick to flow, so that subsequent puncture may be tried with the larger needle and greater force of the aspirator. It is needless to say that all needles used in this way should be previously rendered aseptic by boiling five minutes, best with sodium bicarbonate five per cent. Otherwise it is best to use no needle twice, but to employ a new needle for each occasion. Should the fluid show blood or consist largely of blood, the pericarditis is probably tubercular or cancerous. Tuberculosis, however, by no means always shows a bloody fluid. It may be as clear as the product of a more innocent mycosis. It is a common observation that a fluid which is serous on the first withdrawal may become purulent later, or the fluid may be purulent from the start.

A chronic adhesive pericarditis cannot be distinctly recognized by any special train of symptoms. The retraction at the apex of the walls of the chest by no means always occurs in this condition, and when it occurs does not necessarily indicate the adhesive change. The same may be said of the pulsus paradoxus—*i.e.*, the decrease in the force of the heart which attends an act of inspiration. It is found also in many other conditions.

The *prognosis* is always much more grave than inflammation of the pleura. Pericarditis sicca usually runs a favorable course, and

though the membrane may be thickened by many layers and more or less adhesion produce a partial or complete obliteration of the pericardial sac, there need be no serious disturbance in after-life.

The conditions are not so favorable for rapid or complete absorption in pericarditis as in pleuritis. The fluid is more apt to remain, and lead in the course of time to maceration of the heart as well as interference with its action.

Simple pericarditis without effusion requires little or no *treatment.* Rest in bed or out of it in the recumbent posture, the application of dry cups, an ice bag, or of moist heat, according to the sensations of the patient, with the time of a few days to a week, usually dissipate the disease. The salicylates, in addressing the cause, are as valuable as in pleuritis. Any unusual pain may be relieved by broken doses of Dover's powder gr. iij.–v., or an extreme case by the use of morphia. Sleeplessness may be controlled by trional gr. xv., or chloral gr. v., and nervousness by the bromides gr. xx.–xl. largely diluted. Effusion not too rapid or extensive may be allowed to remain, with the hope that it will disappear by absorption in the course of a few weeks. Should it persist longer, or accumulate so rapidly as to threaten suffocation, pericarditis acutissima, it must be withdrawn at once, under the same or even greater precaution as in pleurisy.

The relief which follows the discharge of even a portion of this fluid is indescribable. The author has seen patients who have been confined to bed for a week, unable to lift the head without vertigo, recover to show a strong pulse, cheerful mien, appetite, and such increase of bodily strength in the course of a few hours as to enable them to sit up and actually leave the house in the course of the following day.

Delay in absorption may often be hastened by the administration of a laxative, preferably calomel in all affections of the heart. The remedy may be given, as in the treatment of dropsy, in doses of three grains three times a day, when benefit may be expected in the course of the third day. Purgation favors osmosis. Any sudden collapse of the heart would call for the analeptics, alcohol, camphor, digitalis, and, more especially for immediate effects, nitroglycerin.

Protracted cases with slight effusion may have absorption hastened by the use of blisters, which are much more efficacious in pericarditis than in pleuritis, or by painting the surface with iodine, and friction with mercurial ointment.

Tuberculosis of the pericardium is not infrequent. Bacilli may be carried directly by the blood vessels, or the disease may extend by contiguity of structure from the lungs to the pleura. The

effusion may remain perfectly clear; it is more frequently tinged with blood, and is sometimes, after caseation, purulent.

SYPHILIS of the pericardium is very rare. It may occur in connection with disease of the heart muscle.

HYDROPERICARDIUM, pneumopericardium, hæmatopericardium, pyocardium (water, air, blood, pus in the cavity of the sac), occur under the same conditions and require the same treatment as in the pleural sac.

ENDOCARDITIS.

Endocarditis.—Infection of the endocardium.

History.—Definite knowledge of disease of the endocardium could date only from the discovery of the circulation by Harvey (1628), following the accurate description of the construction of the heart by Vesalius. Nevertheless these discoveries were not attended with immediate results, and it was almost a century later that Vieussens made mention of the first case of stenosis and insufficiency of the mitral valve. Vieussens recognized also the enlargement of the ventricle and alteration of the pulse, the result of this condition. Lancisi drew attention to the dilatation of the right ventricle and visible changes in the cervical veins. Albertini reinstated palpation in estimating disease of the heart, and Morgagni ascribed cyanosis to interruption of the circulation. Senac was the first to devote himself to the systematic study of disease of the heart. He noticed especially the influence of age and the occurrence of cerebral complications in heart disease. Corvisart reintroduced percussion, which had been neglected since the days of Avenbrugger, in the diagnosis of heart disease, and was the first, according to Laennec, to recognize fremitus as a symptom of valvular disease. Laennec illuminated the whole field by means of auscultation, and made it possible to distinguish the various forms of valve disease in life. Rosenstein gives to Kreisig the credit of basing these diseases upon inflammation of the endocardium. Bouillaud baptized the disease with the name endocarditis, which still remains, and to him is due the credit of having especially emphasized the relation of this affection to rheumatism.

The work of subsequent investigators is more especially that of elaboration and refinement, up to the time of Virchow, who for the first time gave a satisfactory explanation of the distant effects of heart disease, through embolism, in the brain, eye, lungs, kidneys, etc. Traube pointed out the mutual interdependence of the heart and kidneys. Subsequent studies have dealt more exclusively with the etiology of endocarditis.

Etiology.—Endocarditis is said to be primary and secondary. Regarding the primary disease, the same restrictions apply as in pericarditis. Cases become fewer every year where no outside cause can be discovered. It is safer, in the light of existing knowledge, to consider all cases secondary and as expressions, with the inflammations of other serous membranes, of infection. Endocarditis, like pericarditis, may occur in the course or as a sequence of any disease that is produced by micro-organisms. The micro-organisms actually encountered in the study of lesions in the heart are chiefly those of pus and of pneumonia. During its prevalence as an epidemic, influenza may leave lesions in the heart.

The disease presents itself under three distinct *forms:* simple, malignant, and sclerotic. The simple and malignant are acute forms, which result in the sclerotic as the chronic form. It was hoped that the simple might be distinguished from the malignant by the diseases with which these forms respectively were found associated. It is, however, admitted that these forms are variations rather of degree than kind, and that the simple may pass into the malignant form. It has always been admitted that the sclerotic is only a later stage of either of the acute forms. The hope thus entertained proved fallacious, as the same micro-organisms have been found in both forms. The simple form distinguishes itself more frequently by failure to show micro-organisms of any kind, the malignant form by the frequency of the micro-organisms of pus. Weichselbaum made bacteriological examinations of twenty-nine fatal cases of endocarditis. In eight cases of the simple form there were no micro-organisms in the deposits on the valves; seven showed the diplococcus of pneumonia, six the streptococcus, and two the staphylococcus; six showed other rare micro-organisms, the nature of all of which was not definitely established. One case showed three varieties. The relation of these bacteria to the disease was proven by the production of the disease in rabbits in all cases if the membrane had been previously subjected to some mechanical injury. If the valves were healthy it was impossible to excite endocarditis; hence it is inferred that the disease is brought to the valves by the blood in the heart, as well as by the blood vessels of the heart.

Morbid Anatomy.—Simple endocarditis is distinguished by the formation upon the valves of excrescences. The smooth, glistening serous membrane becomes opaque, thickened, and roughened, on account of changes in nutrition and infiltration of small round cells. These roughened surfaces in their motion whip out from the blood fibrin, which comes to be deposited in the form of warty growths, to constitute the form commonly known as the verrucose. Particles from this cauliflower mass, dislodged from the surface of the valve,

are swept onward by the current of blood to block vessels in the brain, lungs (infarction), spleen, kidneys, and the intestinal canal, with the development of characteristic signs. In certain cases destructive changes occur in the fibrinous masses. Necrosis takes place. The tissue crumbles away to leave an ulcer whose surface is sometimes covered with detritus or disorganized blood in the form of a membrane, to constitute the variety known as the ulcerative or diphtheritic form. These particles washed into the circulation excite inflammation at their points of deposit, break down tissue in their vicinity, and form metastatic abscesses. The simple form is found in connection more especially with rheumatism (that is, rheumatic polyarthritis); the malignant with septic diseases (puerperal fever, dysentery, scarlet fever, diphtheria, small-pox, the graver infections). Pneumonia may precede or develop either form. The

FIG. 237.—Endocarditis at and about the aortic valves, with ulceration, perforation of valves, and thrombi: *a*, aorta; *b*, pulmonary artery; *c*, valve covered with vegetations; *d*, perforation of a diseased valve; *e*, ulceration of septum of the ventricles; *f*, ulceration of ventricular surface of mitral valve.

truth is, it is impossible to distinguish the form by the disease which causes the complication. The simplest rheumatism is at times attended or followed by the gravest endocarditis, so that, while it is true that in a general way the gravity of the infection determines the gravity of the complication, exceptions are frequent on both sides.

Endocarditis of any form is most infrequent in connection with diphtheria and typhoid fever among the grave infections, but such simple diseases as mumps and quinsy may produce it. The endocardium may be affected in any part, but inflammation of the membrane which lines the body of the heart, unless ulcerative, is not likely to produce signs. The disease rarely exists upon the mural membrane alone, so that the term itself has come to indicate acute

inflammation of the valves. According to all observation the left side of the heart is much more frequently affected. Statistics from the Berlin Pathological Department, 300 cases, show the lesion in 297 on the left side; in 32 on the right; confined to the left side alone, 268; and to the right side alone, but 3. The very reverse conditions prevail in the fœtus and new-born child. Rauchfuss found 192 cases of fœtal endocarditis in the right side and but 15 in the left. The proportion may not be disputed; the cases were derived from many sources. The mitral valve suffers most. Of the 300 cases just mentioned, tabulated by Sperling, the disease was found 255 times on the mitral, 129 on the aortic, 29 on the tricuspid, and 3 on the pulmonary valves. The mitral valve was affected alone 157 times; the aortic valves alone 40; the tricuspid alone 3 times; the valves of the pulmonary artery alone in not a single case. Emboli occurred in one-fourth of the whole number of cases, and of these 84 cases deposits were found in the kidneys 57 times, the spleen 39 times, the brain 15 times, the liver and alimentary canal 5 times each, and the skin 14 times.

Either form of endocarditis may be accompanied by pericarditis, and is often associated also with affection of the substance of the heart itself (myocarditis). The simple form is most commonly found in connection with rheumatism. The relation of these diseases has been already discussed, with the frequency of complication—ten to forty per cent, as given by various authors. As already stated, it is endocarditis which gives gravity to acute articular rheumatism; so that the patient, especially if the disease be very acute, is watched with solicitude throughout the course of the disease for the development of this affection.

Symptoms.—Endocarditis sets in, as a rule, so *insidiously* that the period of its origin may escape notice. The fact that the patient experiences sensations of distress about the heart or shows irregularity of the pulse in the course of rheumatism does not necessarily indicate the development of the disease; for any affection attended with fever, or more especially with pain, may show these signs. More continuous and persistent complaint of this kind, especially in the absence of much fever or pain, becomes more suspicious. Any *interference with respiration,* any cyanosis however slight, any visible pulsation of the veins of the neck, should call attention to the possibility of endocarditis. For the most part these signs are absent. Careful observations of the *temperature* furnish reliable indications. As a rule the temperature varies in correspondence with the affection of the joints, so that the existence of fever, in the absence of sufficient joint affection to account for it, should lead to an examination of the heart. *In the treatment of rheumatism the*

temperature should be taken four times a day. With the development of endocarditis the heart becomes easily excitable. *The lightest motion,* sitting up in bed, any psychical emotion, *excites the pulse.* The hands and feet, the whole body, easily become cold on the slightest exposure. The patient *complains of chilly sensations,* shows goose flesh, tremor, and tendency to sweat. Examination of the heart discloses excited action, *increased area of impulse,* dislocation of the apex, murmurs which substitute the normal heart sounds. *Diastolic murmurs are especially significant.* With this association of symptoms the diagnosis is plain, and the occurrence of these signs in the course of a simple rheumatism, light pneumonia, or other infection speaks for the existence of simple endocarditis.

The *septic form* is more frequently announced with a *chill* or series of shivering fits, and with *severe pains in the bones and joints,* which latter sometimes swell to present the appearance of rheumatism independently of the general existence of this disease. With the chill and fever, which is irregular, is *anorexia, mental hebetude, prostration.* The disease now shows itself in one of two distinct forms, *the septic or the typhoid.* The septic form distinguishes itself especially by the occurrence of repeated chills, at such intervals at times as to simulate and be mistaken for malarial fever, and more especially by profuse sweats. The chill, fever, and sweat are supposed to be due to metastases, which sometimes reveal themselves by characteristic signs. The typhoid form shows benumbed sensorium, *sopor, stupor, muttering delirium,* along with a dry-coated tongue, sordes about the teeth, *enlargement of the spleen, roseola, and diarrhœa.* The disease is most frequently mistaken for typhoid fever. The temperature curve is not typical, as in a case of typhoid fever, but the fever is sustained at a high level for a period as long, so that the case, even if closely studied, may be regarded as an anomalous typhoid. Endocarditis may be distinguished by examination of the heart, but then only when the heart shows distinctive signs, which is by no means always the case. Irregularities, palpitations, dyspnœa, more particularly more profound prostration, point to ulcerative endocarditis, especially when these signs occur in the course of a grave infection. Typhoid fever is a primary disease, ulcerative endocarditis is secondary, and the sequence must often determine the character of the affection.

Nothing constant may, therefore, be observed about the heart itself, so far as concerns its increase in size, disturbance of sound, or alteration of circulation. One thing only is constant, *the weakness of its action.* The pulse is more feeble, often more frequent, always, as stated, more easily excited. Much of this alteration is due

to affection of the myocardium, which is usually involved in the malignant form of the disease. It must be recognized that septic endocarditis can run its entire course without the development of *metastases.* When they occur they develop in the order of frequency mentioned above. The brain may be affected directly by the deposit of emboli, or functional disturbances of great gravity, but without demonstrable tissue lesions, may show themselves as in the course of grave acute infections. Suppurative meningitis may occur in connection with thrombus of brain sinuses.

The field of vision may be contracted to absolute blindness by hæmorrhage in the retina or embolic occlusion of the central artery. A septic embolus may develop panophthalmitis with destruction of the globe. Affection of one eye is soon followed by affection of the other, as a rule. Hæmorrhages and emboli may also *affect or destroy the hearing.*

The most characteristic changes take place in the *skin.* Minute hæmorrhages, usually petechial, often excessively profuse, occur in the skin, with *eruptions* which simulate those of measles and scarlet fever, herpes and pemphigus, with sero-sanguineous contents. The same *hæmorrhages* may occur also in the conjunctiva and cavity of the mouth. Swelling and pain in the joints have already been noticed. These accidents occur sometimes in consequence of toxæmia, often as the result of embolism. *The spleen is nearly always swollen.* It is this enlargement of the spleen which especially leads to confusion with typhoid fever. Infarctions in the kidneys develop *albuminuria and bloody urine,* which distinguishes itself more especially by its disappearance and recurrence. Occlusion of intestinal vessels reveals itself in *colic, diarrhœa, and peritonitis.* In the lungs there is bronchial catarrh, hæmorrhage, pleurisy, œdema, and hypostasis sub finem vitæ.

The *diagnosis* rests upon the pre-existence of a primary cause. The disease must be distinguished, as stated, from typhoid fever and malaria, from tuberculosis and pneumonia, from the exanthemata and rheumatism.

The *prognosis* is always grave. Nearly all cases of malignant endocarditis perish. The pericarditis is often the terminal link in the chain of disease process. Occasionally recovery occurs even from a case of ulcerative endocarditis, though there is in these cases always room for doubt as to the accuracy of the diagnosis. The prognosis of simple endocarditis is grave, for the reason that a benign course is sometimes suddenly interrupted by an embolus in the brain, which may take life at once or more often produce a sudden hemiplegia. Most of the hemiplegias in the young are due to this cause. Recovery with *restitutio ad integrum* is always possible

in a case of benign endocarditis. All the signs, including the physical signs, may have existed in marked degree and may disappear entirely. This happy conclusion is, however, the exception and not the rule. In the rule the lesion is organic. It persists, and the case is changed from the acute into the subacute or chronic sclerotic form.

SCLEROTIC ENDOCARDITIS.

It is estimated that about one-half of the cases of acute endocarditis become chronic, but sclerotic endocarditis begins often in such subacute form as to pass unrecognized, so that the disease develops insidiously. It is in these cases often only accidentally discovered. In the majority of cases patients consult the physician in relief of symptoms which they themselves refer rather to disease of the lungs. In a respectable proportion of cases the intercurrence of some other affection, especially of the lungs, bronchitis, pleurisy, pneumonia, etc., makes manifest a heart disease which has hitherto run a latent course.

Chronic endocarditis is in its anatomy a sclerotic process. The smooth, pliable, semi-elastic tissue of the valves becomes indurated, stiffened, thickened; nodules form in beads along the free edge of the valves just within the border, at the point of closest contact, on the auriculo-ventricular valves, and about the corpora Arantiæ on the semilunar valves, or chronic thickening of the endocardium which lines the walls of the heart binds down the chordæ tendineæ. Segments of valves are sometimes agglutinated or fastened to the sides of the heart or vessels into which they open. The tissue is thickened and stiffened by deposits of atheromatous matter. The valves are split or perforated by destruction of substance. From whatever cause, the lesion interferes sooner or later with the circulation of the blood, and in such a way as either to prevent the perfect closure of the valves and thus permit *regurgitation*, or to offer obstacle to the passage of blood and thus lead to *obstruction*.

Lesions of the valves are thus divided into insufficiencies (regurgitations) and stenoses (obstructions). While the final event is in all cases the same, the condition which immediately results varies greatly according to the nature of the lesions, and the prognosis of an individual case, other things being equal, rests largely upon the form of the disease. The difficulty, whatever be its nature, is overcome and counteracted for a time by increase in the force of the heart, due to hypertrophy of its muscular substance. In this regard the tissue of the ventricle has great advantage over that of the auricle. Most fortunate are those lesions whose difficulties can be overcome by hypertrophy of the ventricles. Such a hypertrophy is said to be

compensatory. The condition is best illustrated by a comparison of the normal pulse curve with that of mitral regurgitation with perfect compensation. It occurs rapidly in young people and remains in force long, so that the damage which is done to the heart becomes manifest only, as a rule, under extraordinary demands, as from great exertion, or more particularly from disease of the lungs. Sooner or later in all cases the hypertrophy must give way. Any case may be put, but no case can be kept, under ideal surroundings. Some acci-

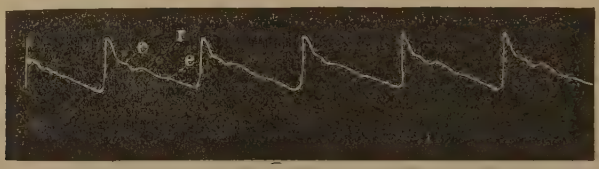


Fig. 238.—Sphygmographic tracing of normal pulse curve: *e*, elevation; *r*, recoil; *e*, elevation of resilience.

dent supervenes. Rheumatism recurs, some other infection develops, an atheromatous process extends to spread the disease over the valve affected or to implicate other valves. The muscular tissue suffers fatty change. The heart undergoes dilatation, and the general signs of heart failure soon appear.

Diagnosis.—The recognition of the valve affected, and the nature of its lesion, is usually easily made. A knowledge of the

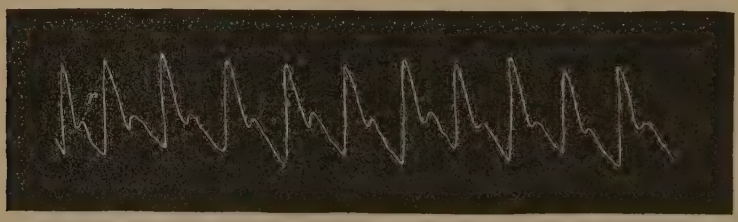


Fig. 239.—Pulse curve of mitral regurgitation with perfect compensation: *r*, recoil.

course of the circulation of the blood in the heart and the cause of its sounds furnishes the basis of diagnosis.

As already stated, the disease process, from whatever cause, endocarditis or atheroma, confines itself largely to the left heart. It becomes necessary practically to distinguish between lesions of the mitral and aortic valves. With the retrograde changes that take place in heart failure under dilatation of the heart, signs of failure of the tricuspid valve are of the main importance. Heart failure is often first announced by insufficiency of the tricuspid valve. In determining the nature of a valvular lesion it is necessary to ascertain

(1) the diameters of the heart, (2) the alterations in its sounds. Of these two factors, by far the most important is the increase of size. Unfortunately this sign is the most difficult of detection. The size of the heart, as determined by percussion, depends so much upon its situation with reference to the overlying lung that considerable hypertrophy may remain unrecognized in life, to be revealed only on autopsy. Any marked enlargement of the heart may, however, as a rule, be readily recognized. Alterations in sounds are more deceptive. Failure to close valves, or the presentation of obstacles, necessarily changes the natural sounds of the heart. But these sounds are

FIG. 240.—Mitral regurgitation with systolic murmur at the apex. S, systole; D, diastole.

altered by so many other factors, irregular vibrations, roughnesses in the walls of vessels, alterations in the composition of the blood, etc., as to make the so-called murmurs comparatively insignificant. The adventitious murmurs usually occur in connection with the contraction of the ventricle, so that murmurs synchronous with the first sound of the heart do not mean as much as those which occur with the second sound, with the diastole. The sounds connected with the lesions of the auriculo-ventricular orifices are heard most distinctly at the apex. Sounds connected with the lesions of the semilunar valves of the aorta and pulmonary artery are most distinct at the base. It is not a question as to where the sounds may be heard, for

FIG. 241.—Mitral stenosis with diastolic—*i.e.*, presystolic—bruit at the apex.

they may be heard all over the chest and sometimes in the back. The question is, where are the sounds heard in greatest intensity? Practically the valves of the heart which demand study are, as stated, the mitral, the aortic, and the tricuspid, which in frequency of affection at the inception of the disease stand to each other in the relation of twenty, ten, and one.

Vierordt represents the various murmurs graphically as shown in Figs. 240–243.

Mitral Regurgitation.—Lesions of the mitral valve are by far the most frequent, and the particular form of lesion is that which prevents closure and permits regurgitation. In this accident the

blood, which should be propelled from the ventricle through the aorta, finds its way, some of it, back into the left auricle, which is thus kept in a state of distention. The auricle undergoes what hypertrophy it may. It is, however, thin and distensible, and speedily undergoes dilatation, so that it is never perfectly emptied. In consequence of this distention the pulmonary veins are overloaded. Blood is dammed back into the lungs, whose capillaries are kept in a state of ectasia. The pulmonary artery is, therefore, overfilled to such degree as to cause in its rebound *a sharp accentuation of the pulmonary valve sound.* To overcome this distention in the pulmonary

FIG. 242.—Aortic regurgitation with diastolic bruit at second right interspace.

artery *the right ventricle undergoes hypertrophy.* It increases in size to such extent that the right border of the heart in a marked case reaches over to and beyond the right border of the sternum.

The recognition of mitral regurgitation rests, therefore, upon the following facts: 1. Dilatation of the left auricle, which may sometimes be recognized by percussion dulness to the left of the sternum at the second rib. 2. Ectasiæ of the capillaries in the lungs, with overdistention of the pulmonary artery and accentuation of the pulmonary valve sound, manifest to auscultation at the left of the sternum at the second interspace. 3. Increase in the transverse diameter of the heart, as determined by percussion dulness extending

FIG. 243.—Aortic stenosis with systolic bruit at second right interspace.

often to the right border of the sternum. 4. Bruit, heard in greatest intensity at the apex and synchronous with the first sound of the heart. 5. As a result of the hypertrophy of the right ventricle, dislocation of the apex to the left. The apex beat may be perceived in the mammary line or between it and the axillary line. The hypertrophy of the right ventricle compensates for the regurgitation for a long time, so that this lesion is looked upon as the most favorable of all the valvular affections. Patients with proper surroundings may live to die of old age.

Mitral Stenosis.—The mitral valve is now so affected as to offer obstacle to the passage of blood from the left auricle to the left ven-

tricle. In mitral stenosis the blood received from the pulmonary veins accumulates in the left auricle. Much of it falls by gravity through the auriculo-ventricular orifice into the left ventricle. Obstacle is offered, as a rule, to the emptying of the auricle in its firmer final contraction. The *bruit* is therefore *presystolic*. The ventricle receives less than the normal amount of blood. The left auricle is distended earlier and more completely. There is consequently quicker and greater distention in the lungs and in the pulmonary artery. The resistance to the column of blood in the pulmonary artery is so great as to *intensify and often delay the closure of the pulmonary valves*. This sound is therefore accentuated early. The delay is at times so great as to separate its sound from that of the aortic valve and thus to *split the second sound*. In a marked case, at the height of the disease there is thus heard over the base a *double click*. The *hypertrophy* which takes place in the *right ventricle* produces the same changes in the heart as in the case of mitral regurgitation. Under the still greater pressure which exists in this instance, the heart muscle more speedily gives way and signs

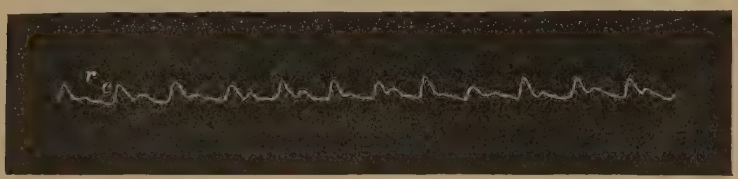


FIG. 214.—Pulse curve in mitral stenosis with broken compensation; feeble ascent, feeble force: *e*, elevation; *r*, recoil.

of *general stagnation* more quickly supervene. The lesion of mitral stenosis is therefore much more grave. The average duration of life ranges about five years. The condition is aggravated by the fact that mitral stenosis almost never exists alone. The lesion which causes the stenosis is so disposed as to prevent closure. Regurgitation exists alone, as a rule. Stenosis alone is an exception.

Aortic Insufficiency is usually due, as stated, to atheroma, a process which begins at the arch of the aorta and extends down to involve the valve at its base. This disease is therefore found much more frequently in age, though successive attacks of rheumatism or other infection may subsequently implicate also the aortic valve. Insufficient closure of the aortic valve permits the reflux of blood from the aorta into the left ventricle. This reflux is immediately propelled under the powerful contraction of the ventricle, and the ventricle thereby undergoes *a degree of hypertrophy which is not approached in any other form of heart disease*. These are the cases of

cor bovinum, where the heart is often quadrupled in its size and may weigh as much as three pounds. This extraordinary hypertrophy of the left ventricle compensates for a time for a deficiency in the blood supply. The condition is recognized by *increase in the size of the heart*, more particularly in the vertical

FIG. 245.—Hypertrophy of the left ventricle from insufficiency and stenosis of the aortic valves: *a*, left, *b*, right ventricle; cross section (Ziegler).

diameter, by a *bruit* which is *heard in greatest intensity at the base and synchronous with the dilatation* of the ventricle—that is, with the second sound of the heart. The force of the ventricular contraction propels the blood with violence into the branches of the aorta, so that the *pulsations of the carotids* are visible in the neck.

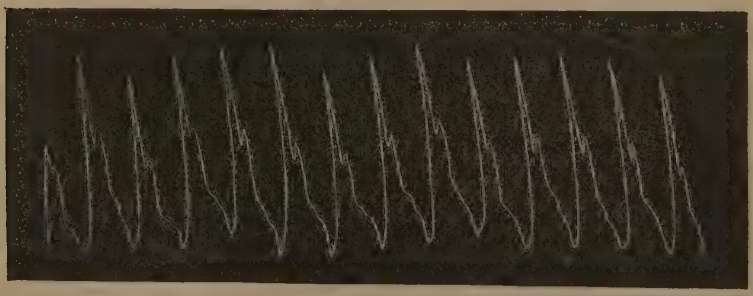


FIG. 246.—Pulse curve in aortic regurgitation. High, perpendicular ascent; sudden descent. Cannon-ball pulse.

In consequence of the regurgitation, the blood in the suddenly distended arteries escapes rapidly in both directions, forward into the capillaries, backward into the heart, so that the vessels undergo a collapse as sudden as the distention. The rapid relaxation of the vessels gives rise to what is known as the *cannon-ball* or *water-*

hammer pulse—the "pouls du Corrigan" it was named in France, in honor of the Irish clinician who first described it. The sudden distention and collapse develops also tones in the great vessels, and bruits may be heard in the femoral, brachial, and carotid arteries. Pulsation is also propagated into the arterioles. The undulations are visible in the retina. The beds of the nails flush and blanch. Cerebral symptoms—vertigo or syncope—are not infrequent.

Aortic Stenosis is more rare. Obstacle is offered at times by agglutinations of segments of the valves, more frequently by such thickenings or adhesions as to prevent apposition of the valve with the wall of the vessel. The ventricle is kept overdistended with blood, and in its contraction forces the blood through the narrowed orifice. The hypertrophy leads to *increase in the diameters of the heart, more especially in the vertical direction.* Auscultation reveals a *bruit* heard in greatest intensity *at the base* in the second right interspace and *synchronous with the first sound of the heart.* The *pulse* in these cases *is hard and wiry.* The

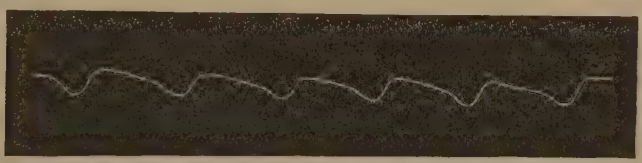


Fig 247.—Pulse curve in aortic stenosis; short ascent, great resistance. Wire pulse.

condition is usually associated with atheroma, which implicates also the vessels of the brain, and headache and cerebral hæmorrhages are frequent complications. Aortic stenosis also seldom exists alone. It is usually associated with aortic regurgitation. Lesions of the aortic valve are, as a rule, more grave than corresponding affections of the mitral valve, chiefly because they more distinctly interfere with the blood supply of the brain and body, but largely on account of the conditions which create them—alcoholism, Bright's disease, age, etc. —which also cause disease elsewhere.

Tricuspid Insufficiency.—So long as compensation continues the patient may suffer no special distress. In consequence of overexertion or intercurrent disease, sooner or later this compensation must give way. Dilatation supervenes and shows itself generally first in the *right ventricle,* which dilates to such degree that the tricuspid valve may no longer close the auriculo-ventricular orifice. This valve is said then to show *relative insufficiency.* The condition is revealed by regurgitation into the right auricle, into the venæ cavæ and jugular veins. So long as the distention of the jugulars

is not too great the *pulsation is seen only in the bulbs,* which protrude at times like the small end of eggs at the root of the neck. Sooner or later the valves of the veins themselves become relatively incompetent and the undulation is transmitted along the whole course of the vessels in the neck. The same regurgitant wave is transmitted downward into the inferior venæ cavæ, and may be felt as *pulsations of the liver* by the hands apposed upon its surface and inserted under the edge of the ribs. Pulsation becomes distinctly palpable and visible also at the epigastrium, where a loud, blowing *murmur, synchronous with the systole,* may now be heard. Signs of general stasis now soon supervene. *Dropsy* begins to show itself about the feet as œdema of the ankles. It disappears during the night, to recur during the following day. The dropsy accumulates to mount up the lower extremities, invade the abdomen and serous sacs or subcutaneous connective tissue over the body, to constitute a general anasarca or sometimes to terminate life by œdema of the lungs.

Interference with the circulation in the lungs is revealed by *cough;* more especially by *shortness of breath,* which is one of the first signs of a flagging heart; sometimes, more exceptionally, by *hæmorrhage.*

The *prognosis* is grave in all cases. The lesion is organic and irremediable. The future of the case depends largely upon its surroundings. The life must be remodelled upon a new basis which would include peace of mind as well as rest of body. Attention must be paid to details, as to diet, clothing, exposure, habits of life, whereby idleness is to be avoided as much as excess.

Tricuspid stenosis is congenital and is very rare. It is marked by presystolic murmur, most intense at the ensiform cartilage, extreme dilatation of the right auricle, and extreme stasis in the whole venous system.

Pulmonary regurgitation, also congenital and rare, is marked by hypertrophy and dilatation of the right ventricle, with diastolic bruit at the base, second left interspace.

Pulmonary stenosis, the most common congenital lesion of the heart, coincides often with a patulous foramen ovale, defects in the ventricular septum, and other malformations. It is marked by cyanosis—"blue births"—the face and fingers are livid, the ends of the fingers clubbed; development is arrested; attacks of dyspnœa, vertigo, syncope are more or less continuous. Nevertheless life may be prolonged at times up to five, ten, or at the outside limit fifteen years. It is often cut short by tuberculosis.

The physical signs are: an intense bruit, most audible at the second left interspace, synchronous with the systole, and extreme hypertrophy or dilatation of the right ventricle.

Treatment.—So long as compensation exists the case calls for no treatment. Compensation may be, in the young, at times excessive, when it may be subdued by occasional doses of the bromides, gr. xx.–xxx. in half a glass of water every two to four hours. The same remedy or a small dose of chloral gr. v. at bedtime, or trional gr. xv. in a cup of hot milk after supper, may secure sleep and allay nervousness. The salicylates should be prescribed at first in acute cases or exacerbations, in address to the cause. The mildest of the antipyretics, phenacetin, may relieve an obstinate headache. Violent action of more continuous character is best subdued by the application of an ice bag to the chest. Hollow tin vessels filled with cold water, in the form of shields, may be worn during the day.

With the first sign of failure—shortness of breath, dropsy, or cyanosis—resort must be had at once to the cardiac stimulants. The evil day may be postponed for a time by the judicious use of alcohol; a dessert- to a tablespoonful or two of good whiskey once or twice in the twenty-four hours may suffice. Sooner or later recourse must be had to digitalis. Mild effects may be had with the use of the tincture in doses of five to fifteen drops every three to six hours. More prompt and powerful effect may be secured by the use of the infusion made fresh from the leaves, a teaspoonful, a dessertspoonful, or a tablespoonful every two to four or six hours. Digitalis remains the most powerful cardiac stimulant. It has the advantage that its action may be sustained. It has the disadvantage that it acts slowly and that in large doses it irritates the stomach. It should never be given uninterruptedly. Its administration should cease so soon as its effect upon the pulse is made manifest, for fear of producing tetanic contraction. Unfortunately digitalis not only stimulates the ventricle but also raises the tension of the capillaries, which therefore, to some degree, resist the action of the heart. A great desideratum was a remedy which would increase the tension of the ventricle and lessen that of the arteries. Such a remedy was found in nitroglycerin. This remedy has the additional advantage that it acts at once. It may be used, to bridge a collapse, in dose of one to two drops in whiskey and water every two to six hours. In imminent danger the drug may be used subcutaneously. It shows its best effects in arterio-capillary sclerosis and defective action of the kidneys. Stasis of the blood in the kidney leads to most disastrous consequences; the secretion of the kidney may be released at once under the action of nitroglycerin. Strychnia, one-per-cent solution, beginning with one drop and gradually increasing, is the remedy *par excellence* for continuous sustentation of the heart. Dropsy is best relieved by calomel. No remedy in the materia medica has the efficacy of calomel in the dropsy of heart disease. It must be given in doses of

three grains three times a day, and no effect must be looked for before the administration of the seventh to the ninth dose. Any irritant effect upon the bowels may be restrained by opium, and ptyalism avoided by the use of chlorate of potash, cleansing the mouth and touching ulcers with caustic (chromic acid). Excessive dropsy may demand puncture of the legs, best with two or four clean silver canulas, rendered aseptic by boiling five minutes with the carbonate of soda, five per cent. Further details of treatment under Heart Failure.

MYOCARDITIS.

Myocarditis (*μῦς*, muscle).—Inflammation (infection) of the substance (muscle) of the heart.

Etiology.—Myocarditis results from the same causes as peri- and endocarditis and presents itself in the same forms, acute and chronic. Infection is conveyed to the myocardium directly through the coronary arteries or indirectly through the endocardium or pericardium. Myocarditis may occur, therefore, in the course of any of the infections, and is always present in some degree in connection with both pericarditis and endocarditis. The micro-organisms which most frequently produce myocarditis are the streptococci and staphylococci of pus. When these organisms are introduced directly into the circulation, as in the experiments of Ribbert with fragments of potato containing pure cultures, myocarditis occurred more frequently than inflammation of the membranes of the heart. So myocarditis occurs, as a rule, in the course of septico-pyæmia. Rheumatism shows preference for the membranes, diphtheria for the walls, of the heart. Interstitial myocarditis—*i.e.*, round-cell infiltration—always occurs in the course of diphtheria, scarlet fever, and typhoid fever.

Morbid Anatomy.—The infection may result in the disintegration of muscular tissue and the formation of abscesses, or in interstitial inflammation with the development of scleroses, scars, or, in consequence of weakening, aneurismal dilatation and rupture.

Symptoms.—The disease is rarely found alone. It occurs in connection with endocarditis and pericarditis, whose symptoms overshadow the lesion of the heart. Myocarditis may be suspected in the presence of the general symptoms of heart disease—palpitation, dyspnœa, dilatation, heart failure, and syncope—in the absence of unmistakable signs of endo- and pericarditis. The dyspnœa of myocarditis is often peculiar. It commonly occurs suddenly in the first hours of the night, and announces itself with the anxiety and distress of asthma. It is known, therefore, as cardiac asthma, and is distinguished from true asthma by the fact that it occurs in later life in connection with other signs of heart disease.

The *diagnosis*, independent of affections of the membranes, is often difficult, sometimes impossible. Myocarditis is commonly announced by a preliminary period of arhythmia marked by periodical acceleration due to direct change in the muscular tissue.

The *treatment* is symptomatic and does not differ from that of affection of the membranes.

HEART FAILURE.

Heart failure from diffuse degeneration (myocarditis) occurs ultimately in all kinds of organic heart disease, and is the immediate cause of death in all the chronic processes. The degeneration is parenchymatous and is chiefly fatty. The striæ grow dim on account of transformation into fat, which appears in granules; more rarely the degeneration is into waxy and amyloid matter. The heart muscle loses color, becomes yellowish, greenish, or mottled, loses firmness, becomes friable and fragile.

Etiology.—The process is usually secondary to valvular disease, in the course of which occurs, first, hypertrophy, then dilatation with degeneration, along with disturbance of compensation. It sets in also in all cases marked by the same sequence, as in the course of emphysema, long-continued, frequent asthma, chronic bronchitis, in obstruction to the circulation outside of the heart. It occurs also in the left ventricle in Bright's disease, aneurism of the aorta, arteriosclerosis, processes which lead to heart failure through hypertrophy, dilatation, and degeneration. Affection of the membranes which cover and line the heart involves zones of subjacent tissue by direct contiguity of structure. Diffuse degeneration sets in also in consequence of insufficient nutrition, from impoverished blood—as in continued hæmorrhage, the various forms of anæmia—from disease of the coronary arteries, and from general chronic disease, tuberculosis, cancer, marked by marasmus. Acute failures are observed most frequently in consequence of the infections, as the result of the direct effect of toxines. Gradual and sudden failures occur in alcoholism. Alcohol is a whip to the heart, which responds as long as may be, but finally breaks down. The heart is always weak in drinkers. It becomes too weak to perform the extra work imposed by disease or effort, or to respond finally even to extra stimulus. Hence the great mortality of drunkards. Depressing mental emotions, anxiety, finally weaken the heart, until it may actually break under a sudden strain—an accident which never happens in sound muscle. Severe or prolonged physical effort, heavy labor, as that of porters, smiths, etc., exhausting discharges, have eventually the same effect. There is no lack of causes to explain the insidious process.

The *symptoms* are almost wholly subjective and depend upon

the retardation of circulation and stasis. There is a feeling of growing weakness, loss of general energy. The lightest effort excites the heart and quickens the breath—conditions which may be noticed first in climbing stairs or in sudden emotional disturbance. Œdema occurs about the ankles at night, disappears in the recumbent posture, and gradually increases in amount during the day. A sense of fulness is felt in the region of the liver. The patient takes cold upon the slightest exposure ; begins to cough ; the face becomes florid or pale ; the mind is more sluggish or anxious ; there is loss of energy, of the power of concentration, and of clearness. Later dropsy becomes marked, cyanosis develops with orthopnœa, cardiac asthma, delirium cordis.

The physical signs, aside from the evidence of valvular disease, are not distinct. Dulness may be appreciated beyond the natural boundaries, especially to the right of the sternum. The apex may be displaced, especially to the left, in consequence of dilatation of the left ventricle. Aside from the irregular and tumultuous actions that betoken exhaustion, the heart sounds are muffled. Aside from the sounds of valve disease, murmurs may be heard, usually systolic, in consequence of relative insufficiency of the mitral or tricuspid valves.

The *diagnosis* is not difficult. The important question concerns the cause, whether disease of the heart, toxæmia, anæmia, alcoholism, obesity, etc. The neuroses of the heart are separated by the absence of physical signs and evidences of general stasis.

Treatment must address itself to the cause, in relief of rheumatism, arterio-sclerosis, anæmia, hæmorrhage, obesity, alcoholism, overwork, etc. Patients affected with emphysema, asthma, and chronic bronchitis may learn to spare the heart extra effort, avoiding at the same time that extreme inactivity which conduces to degeneration and hypertrophy from disuse. Every imprudence in diet is quickly punished. The meals must be regular and the patient must be abstemious. The food should consist chiefly of fruit and fish and the white meat of fowl. All vegetables, except potatoes baked whole, should be avoided. A glass of warm water, at most a cup of very weak tea, is a sufficient supper. An exclusive milk diet will itself sometimes cause œdema and dropsy to disappear. Any overfeeding is hurtful. The exercise must be graded to the individual case. Nothing is worse than actual indolence, except overwork. Climbing stairs is always hurtful, but climbing hills in the open air is helpful if practised aright. Fresh air feeds, and exercise tones, the muscle of the heart. Much can be accomplished by a change of climate, especially by sojourn at watering places—in Germany, Marienbad, Nauheim ; in our own country, the Virginia Springs—with exact regulation of the diet and exercise. Damage is

often done by incautious exercise, as with the Oertel method (Schott). For steady support no remedy equals strychnia. Sooner or later the necessity arises for the administration of the various stimulants, at the head of which is digitalis. Many cases recover absolutely under the judicious use of digitalis, which may be administered in tincture, gtt. v.–x. two or three times a day; fresh infusion, a teaspoonful or two; or powder of the leaves, gr. i.–iij. with sugar of milk at the same interval. Strophanthus, tincture, gtt. xv.–xl., makes a good temporary substitute. Sudden heart failure calls for more powerful stimulants—alcohol, ether, camphor. Thus camphor may be dissolved in ether 1 : 10, and of the mixture ten drops may be administered every fifteen minutes or half-hour, or for still quicker effect be injected subcutaneously. Further details are described under the treatment of valve lesions.

TUBERCULOSIS OF THE HEART.

Tuberculosis of the heart is very rare. Deposit is sometimes found in miliary tuberculosis under the endocardium of the right ventricle. Tuberculosis is more frequent in connection with chronic pericarditis.

SYPHILIS OF THE HEART.

Syphilis of the heart is extremely rare. Most of the lesions so interpreted are cicatrices of arterio-sclerosis. Specific indurations of muscle are sometimes found in connection with inherited or acquired syphilis, and gummatous deposits, sometimes caseous, have been found in the walls of the heart and have broken through into its cavities. Occasional cases of arhythmia, palpitation, etc., otherwise defiant, are cured by appeal to antisyphilitic treatment, as suggested by some accidental finding elsewhere in the body.

CYSTICERCUS.

Cysticercus, echinococcus, may come to lodge in the heart muscle, and, after rupture into its interior, have been disseminated to the lungs or elsewhere over the body.

All these conditions are suspected or recognized by coexistent evidence of disease elsewhere outside of the heart.

NEUROSES OF THE HEART.

The heart muscle may contract and expand—that is, perform its work—entirely independently of the nervous system. The heart muscle may not only contract and expand, but it may do these things rhythmically without nerves. What is muscular tissue, anyhow, but the terminal expansion of nerve fibre? In the body, how-

ever, the heart muscle moves in obedience to nerve stimulus, which excites it or retards it, as Lauder Brunton says, as the whip, the reins, and the brake regulate the movements of the horse and cart.

The mechanism of the nerve supply to the heart, notwithstanding the study which has been expended upon it, is not yet definitely established. Three sets of nerves, the vagus, the sympathetic, and the vaso-motors, have to do with the motions and sensations of the heart, to say nothing of the ganglionic masses embedded in its substance. Recent studies prove that the ganglia belong exclusively to the auricles—*i.e.*, the receiving chambers—and that they are connected exclusively with the sensitive sphere. The ventricles have no ganglia.

The pathology of the nervous affections is even less satisfactory than the physiology, and the neuroses of the heart are studied wholly from the standpoint of symptomatology. It is observed that the heart, so far as motor nerves are concerned, is increased or decreased in the frequency and force of its action, or has its rhythm interrupted, and that regarding the sensory nerves there is distress, anxiety, and positive pain. Disturbances of the motor system are generally summed under the most obtrusive symptom, palpitation, as disturbances of the stomach are summed under the term dyspepsia. Neither of these affections is in any sense a disease, but a symptom of many diseases inside and outside the heart. Continued acceleration and protracted retardation are often characterized as Tachycardia (*ταχύς*, quick) and Bradycardia (*βραδύς*, slow).

PALPITATION.

Palpitation arises, first, in connection with disease of the heart itself. Affections of the valves, of the substance of the heart, of the pericardium, are all sooner or later attended with palpitation. These conditions are excluded from consideration with the neuroses. The causes of motor disturbances are summed under the heads or divisions, mechanical, chemical, and reflex.

1. That overloading of the whole vascular system which occurs immediately after a full meal is often attended by palpitation. Any affection of contiguous viscera, as by accumulation of fluid in the pleural sac; affections of the lung substance itself which may disturb the position of the heart or interfere with the egress of blood from the heart; more especially from distention of the stomach, as from gas, act in a mechanical way. Palpitation of the heart has been noticed among the frequent symptoms of gastric catarrh and dyspepsia. These conditions present often coldness of the surface and extremities, pallor, precordial pain, attacks of syncope, as the result of pressure partly, and partly of absorption of toxic gases. A mode

of taking life in old times consisted in the deglutition of large quantities of fresh blood, the coagulation of which made a solid mass in the distended stomach to interfere with or absolutely arrest the action of the heart. Gaseous distentions of the intestines, especially of the transverse colon, act in the same way. The shock which shows itself early in those enormous accumulations which occur in the course of obstruction of the intestine and after perforations is partly due to this cause.

2. The most frequent causes of palpitation of the heart are the chemical causes, at the head of which stands poisoning by nicotine. Tobacco smokers form a large contingent of cases of heart neuroses. When the disturbance shall have once occurred as a result of the excessive use of tobacco, even a moderate use will suffice to keep it up, so that a cure may follow only entire abandonment of use. Tea, coffee, alcohol in excess, or especially in impure forms, act in the same way. Mention has been made already of the effects of toxic gases in the alimentary canal.

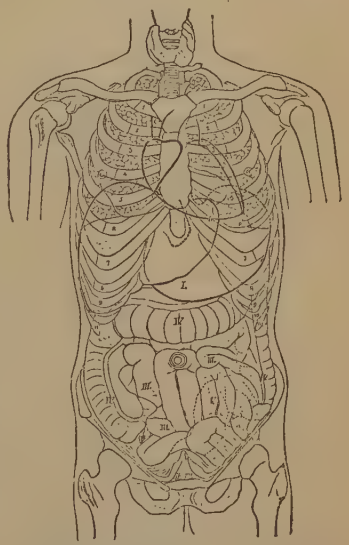


FIG. 218.—Topography of the heart. Mechanical relation of the heart and abdominal aorta to the stomach and contiguous viscera.

3. Reflex causes are numerous. They include also dyspeptic states, disease of the kidney, of the uterus and its adnexa, and any outside irritant. A patient in the experience of the author was often awakened in the night with chilly sensations, extreme anxiety, cold sweat, and violent, tumultuous palpitation. The cause was finally discovered in a subacute prostatitis with posterior urethritis, and the symptoms all subsided under injections, by means of the Ultzmann catheter, of strong solutions of nitrate of silver.

Besides all these things, the heart may be excited by causes of emotional nature and by alterations of the blood, as in chlorosis, anæmia, and exhaustions. So it may be seen that most of the cases of disturbance arise from causes outside the heart. Sometimes the relation between cause and effect may be distinctly traced, as after smoking, the use of alcohol, heavy meals, tea drinking, etc. Often it must be searched for in some disease of remoter organ. Tachycardia and bradycardia may be due to irritation of the abdominal sympathetic (Eccles, Riegel). The practitioner may not overlook the possibility of epileptic basis (Talamon).

Symptoms.—Palpitation is defined as pulsations that are perceived by the patient. It comes on in paroxysms with intervals of more or less complete freedom from attack. The paroxysms may occur at any hour of the day or night. The attacks which occur at night in bed and arouse the individual from sleep are mostly due to disease of the heart itself. The heart begins to beat violently. It pounds against the walls of the chest. The vessels may throb in the neck. The eyes become suffused and the head aches. As a rule the palpitations of the heart are more frequent than the pulsations. All the actions of the heart do not affect the pulse. The heart beats with the fœtal gallop ; or, on the other hand, it may be very rapid and very feeble, so that the pulse may consist of a series of rapid, almost impalpable waves. As Jimenez puts it, it has the rapid vibrations of a loose string. On the other hand, the beatings of the heart may be so feeble as to be scarcely felt by the patient, and these cases create the most alarm. Patients say so long as the heart beats they have no fear; it is only when it seems to stop beating that they become frightened. The pulse in these cases is very feeble, sometimes hardly perceptible. The surface is cold, the expression anxious. Sometimes there is actual syncope. The attack passes off, as a rule, in from half an hour to an hour or more. The more protracted cases are found especially in neurotic or hysterical subjects. The precordial distress and anxiety disappear, the surface becomes warm and the mind tranquil. These attacks may recur several times in the course of the day or at indefinite intervals, with or without connection with distinct exciting cause.

The *prognosis* depends entirely upon the cause. Organic disease must be eliminated, affections of remote organs discovered.

The *treatment* will address itself wholly to the cause. In immediate relief of attack nothing is so good, as a rule, as the application of cold, which may be applied with an ice-water bag, or, better, with the light Leiter's coil. A small dose of chloral gr. v.–x., with a teaspoonful or two of whiskey, is justifiable in a bad case. A bromide, gr. xxx. largely diluted, will often suffice. Dyspeptic cases may be often cured by hydrochloric acid gtt. x. before meals, or by arsenic gtt. iij. after meals. Nervous patients are relieved with the use of valerian, one drachm of the tincture in a tablespoonful of water every fifteen minutes or half an hour. A teaspoonful or two of the tincture of camphor diluted, a pill of asafœtida, the natrobenzoate of caffeine gr. iij. every three hours, the more continuous use of small doses, gtt. ij.–v., of the tincture of digitalis or the tincture of strophanthus, with regulation of the habits and removal of the cause, may cure the condition. Too rapid action (tachycardia) may necessitate the use of morphia; too slow action (bradycardia), of atro-

pia to allay irritation of the vagus from constriction at the aortic valves (Rummo).

ANGINA PECTORIS.

Much more serious are the cases of *sensory* disturbance, because they depend, as a rule, upon organic disease. In these cases a sense of constriction of the chest assumes prominence over all other symptoms; hence the disease is called angina pectoris. Angina pectoris is not, however, strictly speaking, a neurosis of the heart. A true case of angina depends upon disease about the aortic valves, and the disease is of such a nature as to offer obstacle to the escape of blood (stenocardia); hence angina pectoris occurs more especially in individuals of advanced life, from forty to seventy, and in connection with atheroma and arterio-sclerosis. Obstacle offered to the escape of fluid from other hollow viscus—*e.g.*, the bladder—as well as the heart, causes pain. Distention of the left ventricle is attended also with a sense of anxiety and danger like that of impending death. Fortunately angina pectoris is a very rare disease. *Pseudo-anginas*, neuralgias of the heart which simulate the genuine affection, are very common and are very often mistaken for angina pectoris.

Symptoms.—Angina pectoris distinguishes itself especially by *pain*, and by pain which is best described as *agonizing*. The pain seizes the patient suddenly during the day or night. It arises in the præcordium and *radiates thence to the left shoulder and down the left arm*. It may shoot back toward the spine or scapula, in rare cases downward, but the tract described is its usual course. The pain literally transfixes the patient. He lies motionless as if paralyzed. The face shows the picture of terror; it is deathly white or livid; cold sweat beads the surface. The patient may succumb at once in individual attack. Usually the pain subsides in the course of a few minutes, to leave the patient in a state of profound prostration with intense apprehension of subsequent attack.

Diagnosis.—Pseudo-anginas are much less severe. The patient in these cases is able to move about and may adopt various positions or resort to pressure in the attempt to secure relief. Pseudo-anginas occur more particularly in neurotic and hysterical patients, consequently much more frequently in the young and in the female sex. They are found in connection with other neuroses, with anomalies of menstruation, etc. Pseudo-angina is a simple neuralgia, in connection commonly with anæmia, neurasthenia, hysteria, or hyperchondriasis. The individual paroxysm may in these cases last for hours. The diagnosis of true angina rests upon the age of the patient and the sex—the great majority of cases occur in males—as well as upon the recognition of the heart lesion by physical signs.

The *prognosis* is extremely grave. Any attack may be fatal. Yet patients may survive many years.

In *treatment* the most effective remedy is the nitrite of amyl, which, in the smallest dose, has remarkable effect upon involuntary muscle fibre, especially that of the heart. It is used by inhalation of three to five drops from a handkerchief. Victims of this disease learn to carry with them "pearls" containing drops of this drug, which they may crush between the fingers upon a handkerchief and use immediately. With the flushing of the face, which occurs at once from relaxation of the capillaries and emptying of the heart, the patient usually gets relief. Sometimes it fails, when resort must be had at once to ether or chloroform. Nitroglycerin, gtt. i.–iij. every four hours, may later sustain the action of the nitrites. A milder attack, especially if attended by some signs which the patient from his own experience may consider premonitory, may be cut off or cut short by a dose of morphia or chloral. Arsenic and iodine (Fowler's solution and the iodides) are mainly relied upon in the treatment of the intervals. It goes without saying that the victims of this disease must in every way lead model lives.

EXOPHTHALMIC GOÎTRE.

The curious association of symptoms on the part of organs as remote from each other as the heart, the thyroid gland, and the eye, was first pointed out by Basedow (1840), and was described a few years later by Graves, of Dublin, and hence is called in Germany Basedow's, and in English-speaking countries Graves', disease. The connection of goître and palpitation had really been first observed by Flajani, of Rome, in 1802; the Italians still call it the *morbo di Flajani*. Parry (1825) first noticed also the exophthalmos.

The affection is not common, but is noticed much more frequently in women, especially in states of exhaustion, as after rapid child-bearing, prolonged lactation, exhausting discharges, domestic infelicities, etc. Typical cases occur in men, usually without discoverable cause. The disease shows itself, as a rule, between puberty and maturity. It is seldom seen in advanced life, if only because the disease, while not exactly fatal, cuts short the duration of life.

Symptoms.—Usually the first symptom to attract attention is *palpitation of the heart*, frequently in the form of tachycardia. As the disease is often associated with altered conditions of the blood or nervous distress, the palpitation is attributed to these causes, and, being but paroxysmal, is overlooked. A little later the attacks become more common and more continuous. The *heart becomes excitable;* the slightest emotional disturbance or physical effort

precipitates palpitation ; the patient becomes more and more emotional. At this time is noticed also—it may have been remarked before—*fine tremor of the muscles*, especially of the hands. The symptom is not obstrusive, and is usually brought out only upon interrogation. The patient recalls the fact that the condition has existed for many months. The tremor and palpitation may continue for months or for the greater part of a year before the occurrence of other signs. Next there is usually observed some *enlargement of the thyroid gland.* The mode of dress makes a woman sensitive to deformity or alterations about the neck, so that this condition is soon remarked. One or the other lobe of the thyroid swells ; very soon

FIG. 249.—Exophthalmic goitre.

in the course of the disease both lobes become enlarged. Pulsation of the cervical vessels may be seen or felt in the mass. The size of the goître varies from time to time. It comes to a standstill often for months at a time, and increases in size fitfully and irregularly. The nature of the disease is best recognized by the *protrusion of the eyeballs*, or exophthalmos. At first there is but slight increase or pressure against the lids. The aperture of the palpebræ is increased, the eyes appear more full and large. *The movements of the upper eyelid and globe fail to correspond.* The globe follows the lid so slowly in looking upward as to show a line of conjunctiva, and in looking down the pupil is slow to appear (Gräfe). As the protrusion becomes greater it amounts to a positive deformity

and attracts attention at a glance. The lids may so far fail to cover the globe as to develop a condition of dryness and xerophthalmos, in which the eye, if unprotected by mechanical means, may actually slough away.

Etiology.—It has been found very difficult to account for this singular association of symptoms—palpitation of the heart, enlargement of the thyroid, and exophthalmos. The lesion would seem to lie with the nervous system, which is the only means of intercommunication. But the revelations of autopsies have not disclosed as yet definite lesions. It is usually considered an affection of the sympathetic nervous system. Injury or irritation of any part of the

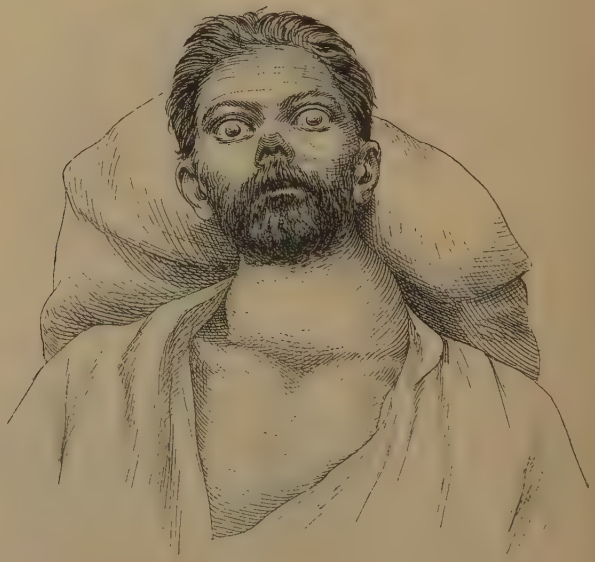


Fig. 250. Fig. 251.

Fig. 250.—Exophthalmic goître. Enlarged thyroid and prominent eyes.
Fig. 251.—Exophthalmic goître. Defective descent of upper lid in looking down (Wilks).

sympathetic may produce the condition. The symptoms may be worked out by lesions of the medulla, and the tendency in our day is to consider the disease as an affection of the medulla through the vaso-motor nerves. The toxic or chemical theory attributes the disease to the affection of the thyroid gland, disease of which is said to produce exophthalmic goître, while destruction of it produces myxœdema. Support for this view is found in the improvement which sometimes occurs after operation, thyroidectomy, and after administration of thyroid extract.

The *diagnosis* rests upon the tripod of symptoms, the association

of palpitation, goître, and exophthalmos, preceded often by tremor and attended by great nervousness, *i.e.*, neurasthenia.

The *prognosis*, so far as life is concerned, is not unfavorable. The disease is obstinate. Absolute recoveries are exceptional. Periods of quiescence occur, and the most that may be promised, as a rule, is arrest at the present stage. Cures have occurred under hygienic means, change of climate, sea air, mountain resort, etc. All cases are benefited in this way. Death from heart failure is sometimes sudden.

Treatment.—The agent most potent in relief of the condition is electricity. One pole, the anode, is put at the nape of the neck, the other, the cathode, is applied in front of the sterno-cleido muscle, and the constant current is allowed to run from five to ten minutes. The tumultuous action of the heart is often stilled in this way. The ice bag may be applied at night over the heart, with intervening towels. Arsenic is the remedy in most general use. Its virtue is empirical. Atropine, ergot, and iodine are agents which may seem to be adapted to an individual case, and may be tried in succession with the hope, usually vain, of securing relief. Tremor may be stilled with hyoscyamine gr. $\frac{1}{100}$. The irregularities of the heart may be checked, if tumultuous, with the bromides, gr. xxx.–xl. largely diluted. Sleep may be secured with small doses (gr. v.–x.) of chloral with a glass of wine, or sulphonal gr. x.–xv. in hot milk, two hours before bedtime. Sometimes the heart requires stimulus. Digitalis is the first resort. It is given in small dose, five to ten drops, three times a day. To relieve the arterial tension digitalis is substituted, often with great benefit, by the tincture of strophanthus gtt. v.–x. three times a day. The natro-benzoate of caffeine, two or three grains every two or three hours, may give comfort for the day.

The author has seen sometimes immediate benefit, but as yet no cure, from the use of the fresh thyroid extract subcutaneously and from the administration of the desiccated extract in powder, gr. v.–xv. in capsule, three or four times a day. Wette reported of thirty cases of thyroidectomy collected in the literature twenty-six improvements or cures, two deaths. Trendelenberg declares that the cures are not permanent.

Excitement and imprudence are quickly punished. The habits of life must be nicely regulated.

MYXŒDEMA.

Disease or destruction (extirpation) of the thyroid gland begets or is followed by three sets of symptoms—nervous, vascular, and metabolic. The mind becomes melancholy, morose, apathetic, and imbecile. Palpitations set in, tachycardia, as in Basedow's disease,

with pallor and anæmia. The number of blood corpuscles is sensibly reduced, and the hæmoglobin is correspondingly lessened. The most curious change occurs in the tissues, which show a mucoid degeneration with œdema. This so-called myxœdema is most visible in the face and hands, which swell to assume a gross and revolting look. The cheeks are puffed out, the lips protrude like sausages, the chin bulges, and the neck grows so big as to make it difficult to turn the head. The hairs fall, the eyebrows are scant, the crines axillares absent altogether. The eyelids swell to such extent as to produce ptosis. The cornea is often barely visible through a narrow slit. The face is a repulsive mask. At the same time the strength is greatly reduced, the patient pants on walking or must actually observe the recumbent posture.

Schiff observed that the dangers of thyroidectomy could be obviated by the insertion into the abdominal cavity of the thyroid gland of another animal of the same species. Horsley suggested the principle in man, and Bircher (1890) actually put it in practice with good results. Lannelongue, Walter, Macpherson, Geraud followed quickly with cases. Howitz, Mackenzie, and Fox fed the gland of the sheep to patients thus affected. Murray and Beatty injected the extract of the gland subcutaneously, and White administered it internally. The dose of the desiccated gland extract is five to fifteen grains three times a day. All patients are improved, many are actually cured, under this treatment.

Acute goître, which is now believed to be an infectious disease whose cause is introduced with the drinking-water, is sometimes quickly and completely cured by large doses of quinine.

DISEASES OF THE BLOOD VESSELS.

ARTERIO-SCLEROSIS.

Arterio-sclerosis; atheroma (ἀθήρη, porridge—*i.e.*, grumous).—Degeneration of the arteries, fatty and atheromatous, usually attended with thickening of the intima, later also the media. Arterio-sclerosis is a natural process in age, where it is found associated with other evidence of senescence, arcus senilis, atrophy of the kidneys, and general atrophy, and the degeneration is an expression of involution.

The condition is precipitated in maturity and youth especially by alcohol, syphilis, and gout; hence it is that "a man is as old as his arteries." It may occur in any condition which raises the pressure in the arterial system—hard work, luxury, sedentary life—and is found usually in association with hypertrophy of the left ventricle. It arises also in connection with retention of toxic elements, diabetes,

uræmia, gout. Men are affected more frequently than women, old people than young. The vessels under greatest strain suffer first—to wit, in the order of descending frequency, the ascending aorta, the arch of the aorta, the descending aorta, the splenic, iliac, and crural arteries, coronary arteries, cerebral arteries, uterine arteries, brachial, ulnar, radial artery, etc. The disease process shows itself as a simple thickening of the intima from hyperplasia of the connective tissue, and is followed by fatty degeneration with the deposit of calcareous matter, often by subsequent ulceration and cicatrization. The vessel loses its resilience, becomes thick and rough. Deposits of chalky matter, which aggregate to form plates, substitute the natural tissue. With the disintegration of this matter, detritus, fatty matter, cholesterin, fibrin from the blood are deposited upon the surface to constitute the atheromatous—*i.e.*, gruel-like—ulcer. In consequence of the increased resistance offered to the action of the heart the vessel becomes elongated, serpentine, dilated into aneurisms, and so friable as to suffer rupture. The thickening of the intima is often so great as to lead to thrombosis with more or less perfect occlusion (endarteritis obliterans).

Symptoms.—The condition is sometimes easily recognized. Atheromatous vessels may be seen or felt in the radial and temporal regions as tortuous, pulsating tubes, unyielding, rigid to the touch. Sometimes the artery at the wrist feels like a chain of beads. More frequently these vessels escape while internal arteries are affected. Hypertrophy of the heart without other explanation (valve lesion, Bright's disease), in association with disease which might produce the condition, may lead to diagnosis. Attacks of angina pectoris and cardiac asthma may indicate sclerosis of the coronary arteries. The diameters of the heart are increased on account of hypertrophy or dilatation. The impact is more violent and extensive, the apex somewhat dislocated. The pulse is full, strong, and unyielding; it may be retarded. The aortic valve sound, heard best at the base at the second right interspace, is accentuated. Hæmorrhage or evidence of softening may indicate rupture, aneurismal dilatation, thrombosis or embolism of the brain arteries. Sooner or later supervene the signs of dilatation and degeneration of the heart, with œdema, stasis, sometimes with uræmia in connection with Bright's disease and with gangrene in connection with diabetes.

The *diagnosis* rests upon the hypertrophy of the left ventricle in association with increased tension in the vessels, independent of physiological overgrowth, valvular disease, Bright's disease, etc.

The *prognosis* is always grave. The patient stands in constant danger of cerebral hæmorrhage, thrombosis, and embolism. Through affection of the coronary arteries he is menaced also with angina

pectoris and cardiac asthma. With the perfection of proper apparatus it must soon be the case that estimate of the duration of life, as for annuities, life insurance, etc., will be based largely upon the pressure of the blood in the arteries.

The *treatment* must address itself to the cause, and may be efficacious only when the cause—alcoholism, gout, diabetes—may be removed. The diet and the mode of life must be regulated to the new or developing conditions. Exercise in the open air (horseback), the free libation of mineral waters, simple, wholesome food, regular sleep, good habits, and cheerful surroundings longest postpone or best protect the patient against the remoter evils of this disease.

Alanus advises the exhibition of a mixed diet, especially of meat, basing the recommendation upon the observation that the Hindoos, who feed exclusively upon rice, and certain quite young monks in cloisters, with other vegetarians, suffer premature arterio-sclerosis (atheroma) from deposit of the excess of mineral salts.

ANEURISM OF THE AORTA.

The lack of resilience imparted to an artery by arterio-sclerosis causes it to yield before the impact of blood and leads to dilatation of its walls. The dilatation may be saccular, cylindrical, or spindle-shaped. Because subjected to greatest pressure it occurs most frequently in the ascending aorta and in the arch of the aorta. Such a dilatation constitutes an aneurism (*ανευρύνω*, to widen), which may vary from a scarcely perceptible enlargement to the size of a man's head. The sac of the aneurism is filled with blood, which coagulates in layers, and from which fragments may be detached to constitute emboli. Men are affected more frequently than women, because men are the more frequent subjects of the cause of arterio-sclerosis—to wit, syphilis, alcohol, hard work, and gout. The great majority of cases occur, therefore, between the ages of thirty and fifty.

The *symptoms* depend chiefly upon pressure, and occur in number and severity according to the direction of the growth and the structures implicated. Aneurism remains for a long time latent. Symptoms are absent altogether in one-fifth of cases. Among the subjective symptoms may be mentioned *sensations of fulness, pulsation and oppression, pains in the chest or back, vertigo, headache, hoarseness, etc.* As these symptoms may be all due to many causes, the objective symptoms assume prominence. Inspection may reveal distention, *bulging of the chest*, or the actual presence of a *pulsating tumor*. Usually the pulsation is felt on the right or left of the sternum, or between the spinal column and the scapula, according as the aneurism is situated in the ascending aorta, arch of the aorta, or descending aorta. Sometimes it is first appreciated by

the finger introduced behind the sternum in the neck, when the head is retracted and the larynx lifted up. The *aneurismal bruit* may be heard in these situations or along the line of the carotids. As the disease advances, *a tumor*, most frequently at the second right interspace, becomes more and more visible, or dulness in this region indicates its presence. Soft, blowing sounds are heard on auscultation in both systole and diastole. The sounds are intensified with insufficiency or stenosis at the aortic valves. The heart is often displaced toward the left in aneurism of the ascending aorta, and toward the right in aneurism of the descending aorta. Sometimes the blood wave is unequally distributed to the two sides, so that *the left radial and carotid pulse may be feebler or retarded.* The sphygmograph shows reduction in the line of ascent, absence of sec-

Fig. 252.

Fig. 253.

Fig. 252.—Aneurism of femoral artery : *a*, adventitia ; *b*, intima ; *c*, muscularis, present only at entrance of sac (Weber).

Fig. 253.—Aneurisms, *a*, *a*, of the hypogastric artery.

ondary vibrations. The veins of the thorax and the upper extremities, on account of interference with the return current from compression of the right auricle, may become tortuous, and œdema may develop upon the side of the chest—conditions more frequently encountered in mediastinal tumors than aneurisms. *Dyspnœa and cyanosis* may develop from direct compression of the trachea and bronchi, and *dysphagia* from compression of the œsophagus. *Hoarseness of voice,* aphonia from paresis and paralysis of the left vocal cord, is often an early symptom of pressure on the left recurrent nerve. Double paralysis occurs more frequently in tumors. Pressure upon the brachial plexus develops *pain, paræsthesiæ, and paresis* in the upper extremities. The gradual development of the

aneurism leads to consumption, usury, of everything before it, including bones, sternum, vertebral column, etc.

Aneurism of the Abdominal Aorta reveals itself as a pulsating tumor in front of the vertebræ, at first above the umbilicus. Aneurism at this seat remains for a long time latent, and is usually suspected on account of *obstinate pains* (gastralgia, enteralgia) and

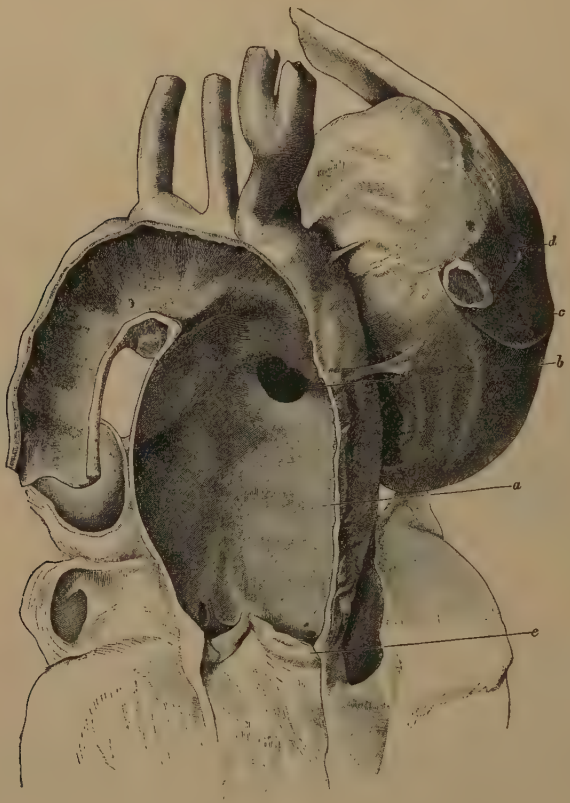


FIG. 254.—Aneurism of the aorta : *a*, aorta ; *c*, a fusiform aneurism of ascending aorta communicating at *b* with the dilated aorta ; *d*, rib adherent to sac of aneurism ; *e*, shrunken aortic valves.

paresis in the abdomen or lower extremities. The condition is often mistaken for neuralgia or rheumatism for months, sometimes for years, until the tumor makes itself manifest. Sometimes the diagnosis is only made by the collapse which follows rupture. The aneurism may thus discharge itself suddenly with sudden death, or gradually with the symptoms of chronic anæmia.

Aneurism of the aorta may at any time terminate suddenly, or

may last for years with slight or severe symptoms. Aneurism of the thoracic aorta may discharge itself into the œsophagus or stomach to be attended with hæmatemesis, or into the trachea or bronchi to produce suffocation, into the pericardium to cause sudden death. On account of defective nutrition it is often attended with tuberculosis. Aneurism of the abdominal aorta may discharge itself into the peritoneal sac, left pleura, intestine, and stomach. Sometimes the blood in coagula fills the aneurism and the patient makes a perfect recovery.

The *diagnosis* rests upon the recognition of a cause—alcoholism, syphilis, gout, trauma with the signs of pressure, aphonia, œdema, dysphagia—and the discovery of a fluctuating, pulsating tumor with bruits at the second right interspace and in the jugulum. Abscess is distinguished by its greater extent, tenser walls, points or surfaces indicating suppuration. Malignant growths show no fluctuation or pulsation. Doubt which may not be settled by careful examination may be dispelled by the introduction of the finest needle of the aspirator—a procedure, according to Fürbringer, unattended with any danger.

Fig. 255.—Section of aneurism filled with clot, surrounded by dense layers of connective (fibrous) tissue (Wagstaffe).

The *prognosis* is always grave. The danger is from rupture and compression of important structures.

The *treatment* should address itself to the cause in the cure of alcoholism, syphilis, and gout. The best outlook is offered in syphilitic arteriosclerosis, where systematic use of mercurial ointment and iodide of potassium may be followed with the best results. Repeated subcutaneous injection of ergotin or sclerotinic acid sometimes leads to contraction of the sac. Acupuncture and galvano-puncture, the introduction of fluids, the introduction of solids (wire) to bring about coagulation of the blood, are procedures, not unattended with danger (embolism), sometimes resorted to in protection against the greater evils of aneurism.

PHLEBITIS.

The veins show the same changes as the arteries, but less frequently and in a less pronounced form. Fatty degeneration, atheroma, sclerosis, are changes which begin in the intima of the veins as well as in the arteries, and lead likewise to dilatation, phlebectasis, varices, rupture. The most common lesion is the formation, in con-

nection with the infections (typhoid fever, pneumonia, septicæmia, dysentery), of a thrombus, which occurs especially in the veins of the lower extremities (milk leg) and the pelvis, not infrequently in the sinuses of the dura mater, more rarely in the portal veins—pylephlebitis. Cicatrization may occur in the region of the thrombus, with

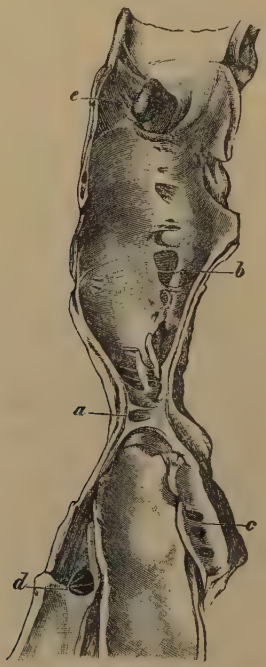


Fig. 256.—Obliteration of right femoral vein, showing remains of a thrombosis three years before death: *a*, site of obliteration; *b*, *c*, *d*, connective tissue in interior of vein and its branches; *e*, recent thrombus. Natural size (Ziegler).

contraction and obliteration, so that the vein may be converted into a fibrous cord. Circulation must now be conducted by collateral veins. Calcification may occur, with the formation of phleboliths, or toxic processes may result in suppuration.

CHAPTER VIII.

DISEASES OF THE BLOOD.

Affections or anomalies of the blood concern both quantity and quality, and in either case are felt from the nature and distribution of this circulating fluid in every organ of the body.

To get reliable data blood must be examined fresh. Fortunately, a drop or two, as taken with a fine lance (not with a needle) from the finger or from the lobe of the ear, suffice for all clinical purposes. Blood thus collected, as it exudes, is studied without pressure from the cover glass, that first the process of nummulation may be observed. This process occurs in all healthy blood. Absence of it or imperfect performance of it indicates at once the existence of a grave disease. Second, the fresh drop is studied as to its corpuscular elements—their number, size, color, shape, nucleation, relative proportions, etc. A solution of common salt, 0.75 per cent, will keep the corpuscles unaltered for longer study.

Excesses in *quantity* are distinguished as plethora (πλῆθος, fulness), which is recognized by fulness of vessels, flushing of the face, headache, tension of the pulse, increased impact of the heart, palpitation, etc. Such plethora is noticed after suppression of habitual hæmorrhages, hæmorrhoids, epistaxis, menorrhagia, and after transfusion. Flushing of the face, with dilatation of vessels, may mean not general but local plethora in paretic and dilated blood vessels. The plethora of the drinker, in association with acne, may be thus wholly paretic and local. Plethora is called serous when the proportion of water is above eighty per cent. Serous plethora, which gives rise to local œdema and general anasarca, is observed more especially in disease of the kidneys. The blood is diminished in amount after heavy losses, hæmoptysis, hæmatemesis, or other hæmorrhage, to constitute the condition called oligæmia or, more commonly but improperly, anæmia.

Anomalies of *composition* exist in hydræmia (ὕδωρ, water), a relative increase of water, observed especially in Bright's disease; and anhydræmia, a relative decrease of water, observed after profuse watery discharges, diarrhœa, dysentery, cholera morbus, and Asiatic cholera.

Slight inspissations of the blood occur in the course of fevers, after the thirst cure, etc. Changes in the hæmoglobin are best estimated by means of Gowers' hæmoglobinometer. The normal per cent of hæmoglobin is, in the male, 13.77; in the female, 12.59. Information sufficiently accurate for practical purposes is obtained by the colorimetric test. The color imparted by dissolving a drop of blood in distilled water is compared with a previously prepared normally colored glass. The glass devised by Fleischl gives a scale of percentage. It is highest in the new-born, is reduced to one-half in the first years of life, increases from the age of twenty-one to forty-five, and is later again reduced. The hæmoglobin corresponds closely, but not absolutely, to the number of red blood corpuscles. It may be increased 120 per cent above the normal. It is reduced in anæmia in all its forms, in malnutrition from any cause, tuberculosis, cancer, or other cachexias. It is especially diminished in amount in chlorosis, pernicious anæmia, and leukæmia. The reduction in leukæmia runs parallel with the reduction in red blood corpuscles, while in chlorosis, notwithstanding the reduction of hæmoglobin, the corpuscles may be normal in number. Hæmoglobin may be reduced 10 per cent below the normal. In marked reduction the blood is visibly pale.

The albuminates exist in the blood in combination with the hæmoglobin and in solution in the plasma (8 to 10 per cent). Increase (hyperalbuminosis) occurs in association with inspissation of the blood; decrease (hypalbuminosis) with hydræmia and marasmus.

Fibrin, which exists normally in the proportion of 0.1 to 0.4 per cent, may be increased (hyperinosis) to 1 per cent, as in croupous pneumonia, acute rheumatism, etc.; or decreased (hypinosis) in the acute infections and various poisonings (prussic acid, sulphuretted hydrogen, alcohol, etc.).

Salt should exist in the blood in the proportion of 0.85 per cent. Reduction is especially noticed in the sputum of pneumonia, and reappearance is recognized evidence of resolution. The sign has lost much of its value since it has been learned that the variations are largely due to food. Reductions are in all cases speedily regulated.

Increase of fat, which exists normally in the proportion of 0.1 to 0.2 per cent, shows itself in increased, or milky, opacity of the plasma. It is observed after excessive indulgence in fat, obesity, any disease attended by albuminoid degenerations, affections of the liver, alcoholism, and marasmus. Globules of fat may escape from the bone marrow after injuries to bone, to block capillaries in the lungs and to produce the dangerous affection known as fatty embolism.

Increase of grape sugar, which exists normally in the proportion of 0.1 to 0.15 per cent of the plasma, is observed after hæmorrhage and in the course of diabetes. Any excess above 0.9 per cent is excreted with the urine.

Urea, which may exist in normal blood in the proportion of 0.016 per cent, and urates (traces), accumulate in consequence of disease of the kidneys and failure of elimination, to produce the condition known as uræmia (*οὶρον*, urine). Increase of uric acid occurs in gout.

Increase of bile pigment, cholæmia (*χολή*, bile), shows itself in icterus. Small quantities are detected in the blood by filtration of the serum, withdrawn by cupping and separated from the clot, and coagulation at 70° to 80° C. After repeated heating to 50° to 60° C., serum assumes, in the presence of bile, a grass-green color. Dissolution of the red blood corpuscles, with liberation of coloring matter, constitutes hæmoglobinæmia and hæmoglobinuria. These conditions occur in consequence of the infections, freezing, extensive burns, after transfusion of heterogeneous blood, in poisoning by chlorate of potash, tincture of iodine, arsenic, etc. (Stintzing). Melanæmia results from dissolution of the red blood corpuscles and liberation of black pigment granules in the course of malaria. Small quantities of air may make the round of the circulation and be absorbed without damage. Larger quantities make the blood foamy, block the right heart or pulmonary vessels, and thus produce sudden death.

Alterations of the *corpuscular elements* concern number, color, form, and composition.

Healthy male blood should contain 5,000,000 red corpuscles, female 4,000,000, to the cubic millimetre. Plethora of corpuscles (polycythæmia) (*πολύς, κύτος*, many cell) may increase the number to 7,000,000, with increase of hæmoglobin from 13 to 16 per cent. Conditions which lead to inspissation of the blood, watery discharges, etc., produce this effect. Blood corpuscles may be increased in high degrees of heart failure to 8,800,000 in one cubic millimetre.

Decrease (oligocythæmia) is a constant attendant of anæmia, chronic diseases marked by malnutrition, and marasmus. The blood corpuscles may be decreased in pernicious anæmia to 1,000,000 or 500,000 to the cubic millimetre.

Blood corpuscles increased in size to a diameter of 9.5–10.0 μ and over are called giant blood cells—macrocytes. They are seen in certain anæmias, chlorosis, cholæmia, lead poisoning, especially after hæmorrhages, and often in connection with microcytes. Corpuscles decreased to 6.5 μ are called dwarf corpuscles. Microcytes are small, globular bodies which are found in high fever, severe chronic

anæmia, extensive burns, poisoning by morphia, carbolic acid, and especially in septicæmia. Megaloblasts are giant cells with nuclei.

Changes of form are distinguished as poikilocytosis (ποικίλος, varied). Such alterations are seen in light degree in chlorosis, leukæmia, and secondary anæmia; in high degree in progressive pernicious anæmia.

The number of white blood corpuscles is more variable than that of the red. A cubic millimetre of blood contains, on the average, 5,000 to 10,000 white corpuscles. The proportion of white to red ranges between 1 : 400 and 1 : 1000. Amœboid motion continues, under heat and moisture, two to three hours. The leucocytes, as they may be stained, are divided (Ehrlich) into (1) basophile, which may be colored with basic aniline dyes (methylene violet, fuchsin), found in connective tissue ("mast" cells) but not in normal blood; (2) eosinophile, whose granules take up the acid dyes, especially eosin, rarely found in normal blood; (3) neutrophile, colored with neutral dyes (methylene blue, acid fuchsin), which form the bulk of the white corpuscles of the blood. All the pus corpuscles belong to this group.

Fig. 257.—Poikilocythæmia: *a*, normal, *b*, reduced red blood corpuscles; *c*, different forms of degenerated red blood corpuscles (poikilocytes). × 500. (Ziegler.)

White blood corpuscles are further divided into mononuclear and polynuclear cells. The mononuclear cells constitute 25 per cent (varying between 15 and 35 per cent) and the polynuclear 75 per cent of the whole number. Transition forms are not infrequent.

Absolute increase in number indicates either leukocytosis or leukæmia. Leukocytosis is a relative increase from 1 : 400 to 1 : 50. It occurs, as a rule, in the course of the acute infections and chronic wasting diseases. The proportion may be reduced in the death agony to 1 : 5 (Litten). The reduction reaches in leukæmia its highest grade; it may fall to 1 : 1. Increase in the eosinophile cells indicates leukæmia. The sign is of not so much value in children, where these cells may be increased to 15 to 20 per cent of the whole number of leukocytes, independent of affections of the spleen or bones.

BLOOD PARASITES.

The parasites found in the blood are both animal and vegetable. The animal parasites, Distoma, Filaria, and Plasmodium malariæ, have been already described.

In examining for vegetable parasites (bacteria), the end of the finger punctured for blood must be first thoroughly washed with soap

and sublimate solution 1 : 1000, and this solution subsequently washed off with, first, alcohol, then ether. The lancet, cooled after having been heated to redness, makes the slight cut necessary to secure the blood. The slide and cover glass must be cleaned and disinfected like the finger. The drop of blood should be dried under a bell-glass cover and then heated, or should be three times drawn through the flame of an alcohol lamp to fix it. The preparation is stained with the aniline or other coloring matters, as already specified. A good microscope is required, provided with a condenser, best with the Abbé illuminating apparatus.

Of the bacteria found in the blood, the Bacillus anthracis and the recurrens spirillum are sufficiently distinguished, so far as the diseases of man are concerned, by their morphology alone. The bacillus of glanders is readily recognized by inoculation, and the typhoid bacillus demands culture to confirm a diagnosis.

The *tubercle bacillus* may be disclosed after the manner specified in the study of the sputum, but is more readily shown by the method of Gabett. The preparation of blood is immersed two minutes in the solution of carbol fuchsin specified, in a watch glass. It is then washed off with distilled water, and thereupon immersed for about one minute in a methylene-blue and sulphuric-acid solution (methylene blue one to two parts ; sulphuric acid, twenty-five per cent solution, one hundred parts ; both solutions to be filtered). The methylene-blue solution is to be decolorized immediately and stained as specified in the study of the sputum. A power of four hundred diameters displays the deep-red tubercle bacilli on a delicate blue ground without other tone of red. These solutions of Gabett have the advantage that they keep for months. The examination of the blood is made only in acute miliary tuberculosis, in which all sputum is absent ; and as the bacilli are in all cases so few and far apart, the blood, a venesection-cupful, should be allowed to stand several hours and the sediment and clot broken up fine with a glass rod. After this procedure an unmistakable specimen or two is usually found. But while a positive discovery declares the diagnosis, negative evidence does not exclude the disease.

Lepra bacilli have been found in the blood in the beginning of a new eruption. The diagnosis is usually made, however, from the masses in the skin. The bacilli of lepra closely resemble those of tuberculosis, but differ from them and all other bacteria in the fact that they are colored red by immersion six minutes in a concentrated alcoholic solution of fuchsin and subsequent washing of the superfluous color in a mixture of nitric acid one part, alcohol ten parts. All other bacteria are colorless—*i.e.*, are decolorized by this method.

ANÆMIA.

Anæmia (ἀν, without, αἷμα, blood), more properly oligæmia (ὀλίγος, little), acute and chronic, is called primary or essential when its cause is concealed, and secondary when it occurs in the course, or in consequence, of various discoverable diseases.

Anæmia is most acute after direct loss of blood, from whatever cause, whether the hæmorrhage be manifest or concealed—ulcer of the stomach, rupture of aneurism, tubal pregnancy, etc. Tolerance to hæmorrhage varies. Infants and aged people fall into collapse with losses which might be safely endured at maturity. Women endure hæmorrhage better than men, the thin better than the obese. The loss of a third of the whole amount of blood is necessarily fatal; the loss of a less amount, whereby the blood corpuscles are reduced one-half—from 5,000,000 to 2,500,000 to 2,000,000 in one cubic millimetre, in disproportion thus to the amount of the blood itself—is often fatal. Blood corpuscles are rapidly restored in convalescence at the rate of 150,000 to 170,000 per day (Laache). The hæmoglobin is not so quickly restored; hence the more persistent pallor of the skin.

Symptoms.—Acute anæmia, as from hæmorrhage, is attended by *pallor, cyanosis, and collapse;* the skin is cold and clammy; the heart's action is weak and fluttering. Ringing in the ears, vertigo, dyspnœa, precordial anxiety, retching and vomiting, faintness, convulsions, and loss of consciousness are the common signs of rapid loss of blood.

Chronic anæmia results from repeated hæmorrhage or other losses, prolonged lactation, onanism, suppuration, or other profuse discharge, diarrhœa, albuminuria, leucorrhœa, fever, melancholia, protracted insomnia, chronic infections, tuberculosis, malaria, scurvy, syphilis, cancer, certain intestinal parasites, especially those which draw blood, anchylostomum, etc.

Chronic anæmia shows itself in reduction of the red corpuscles. It is most frequently seen in connection with cachexia, cancer, amyloid degeneration, tuberculosis, malaria, syphilis, poisoning by arsenic, lead, mercury. In aggravated cases there is also poikilocytosis. In these cases the albuminates may fall from 8 to 4 per cent and the specific gravity from 1030 to 1013. Cachexia develops gradually; *the face is gray*, or greenish gray, from deposit of pigment matter from disintegrated blood cells. On account of the lack of nutrition *emaciation* gradually develops, the fat disappears, later the muscular tissue; the patient falls into marasmus; the action of the heart is enfeebled; the valves show relative insufficiency, and, in consequence of irregular vibration, yield to auscultation a *systolic murmur*. Anæmic murmurs are heard also in the course of the arteries

and veins, especially at the root of the neck. The heart is excitable through weakness and without apparent provocation. The symptoms of *stasis* supervene sooner or later—*œdema* about the ankles, in the serous sacs, *cyanosis, diminution of urine*, albuminuria, bronchial catarrh, and *œdema of the lungs*. In consequence of nutritive change in the endothelium, marantic thrombosis is wont to occur in various veins, including the sinuses of the brain. Epistaxis, retinal hæmorrhage, metrorrhagia, are hæmorrhages which may occur by diapedesis in cases of aggravated anæmia. Insomnia, disturbances of special sense, paræsthesia, hyperæsthesia, mental affections, hallucinations, vary the scene. All anæmic patients are more or less dyspeptic, partly from diminution of secretion, partly from atony. Menstruation is disturbed in every way.

The *diagnosis* of anæmia is usually easy, and the *prognosis* depends upon the cause. Loss of blood up to one per cent of the weight of the body is made up in two to five days ; up to three per cent, in five to fourteen days ; in larger amounts, in fourteen to thirty days (Lyon). The hæmoglobin, as stated, is restored less rapidly than the corpuscles.

In the *treatment* of anæmia it must be remembered that the condition is usually only secondary. Address must be made to the cause. The treatment of anæmia may resolve itself into the treatment of tuberculosis, Bright's disease, diabetes, affections of the uterus, gastric catarrh, intestinal parasites, etc. Acute cases, as after hæmorrhage (gastric ulcer), are sometimes rescued by the transfusion of the physiological salt solution of one to one and a half pints, one-half drachm to the pint. Transfusion may be made into the veins of the arm or upper thigh, or, more safely, under the skin as in the treatment of cholera. In cases of extreme collapse the intravenous method is to be preferred. Patients apparently in articulo mortis have been rescued in this way. Alcohol may be introduced also subcutaneously, or, better, camphor dissolved in sulphuric ether, in the proportion of 1 : 10, introduced in syringeful doses under the skin. In subacute or chronic cases the best remedy is iron. What form of iron is given matters but little. Many practitioners still prefer the old Blaud pill. The following is the original formula of Blaud (1831) :

℞ Ferri sulphatis.....gr. xv.
Potassii subcarbonatis.....gr. xv.
Reduce separately to a very fine powder. Mix very slowly, little by little, and add—
Mucilaginis adragantis..... q. s.
Rub thoroughly and forcibly to a mass, and divide into forty-eight pills.

The more modern preparations, albuminated or peptonized, owe

their superiority only to the power of suggestion. Probably the same explanation will account for the virtues of the artificial hæmoglobin, as we do not understand as yet the iron combination in the complex molecule hæmoglobin. The tincture of the chloride of iron in sweetened water is indicated with any tendency to diarrhœa. Generally the tendency is toward constipation. The saccharated carbonate may be given in teaspoonful doses three times a day. The compound mixture of iron is an unpleasant but very efficacious form; dose, one tablespoonful three times a day. A pill of reduced iron, one to two grains at a dose, in connection with one or two drops of Fowler's solution of arsenic, makes a fine blood tonic. Roncegno water contains more arsenic than iron. Food and fresh air are even more essential agents in the successful treatment of anæmia.

PERNICIOUS ANÆMIA.

Progressive, essential, idiopathic anæmia.

Etiology.—The disease occurs more frequently in maturity, exceptionally in children. Women are attacked more frequently than men, on account of the liabilities of pregnancy. The disease is more common in Europe, especially in Switzerland, and is rare with us. Like all diseases whose cause is obscure, it has been attributed to accidents or conditions which preceded it (thus, to defective nutrition, exhausting discharges, frequent pregnancies, hæmorrhages, ulcers of the stomach and intestine, malaria, syphilis, cancer, alcoholism, intestinal parasites, anchylostomum, bothriocephalus), sometimes without other foundation than sequence. Von Jacksch claims a parasitic origin; Petrone and Holtz consider the disease infectious.

Symptoms.—The most obtrusive symptom is the *pallor of the skin and exposed mucous membranes.* The face is white and the mucous membranes blanched. On account of the extreme poverty of the blood, *œdema* occurs about the ankles and face, with effusions later into the serous sacs. Nevertheless *nutrition is preserved* and the adipose tissue is not lost. The *temperature* is subject to great fluctuation. The disease is usually attended with *fever*, hence the synonym "febrile anæmia." It is usually of more or less remittent type. The temperature rises and falls without discoverable cause, and the subjective condition is often better during fever (Van Noorden). *Disturbances on the part of the digestive system* are frequent. Thirst, fœtor of the breath, nausea and vomiting, obstinate diarrhœa, belong to the condition. On the other hand, the appetite is sometimes voracious and constipation prevails. The epigastrium is always tender to pressure. The urine is sometimes increased, sometimes diminished; it may show increase of indican, uric acid, and peptones. The brain suffers for want of healthy blood. Some

patients are excitable, others indifferent. Insomnia may alternate with sopor. *Neuralgias, paræsthesiæ, pareses, apoplectiform attacks, and delirium,* even outbreaks of mania, may occur in the course of the disease. Patients complain of *weakness,* which is manifest from the beginning.

The blood is thin and pale, more the color of amber than blood (Weiss), exceptionally dark (Gusserow), poor in iron (Rokitansky). *The blood corpuscles suffer enormous diminution,* below a million down to half a million—in a case recorded by Quincke 143,000 in one cubic millimetre. The *hæmoglobin* is reduced to one-tenth of the normal, less in degree than the red blood corpuscles —*a disproportion considered characteristic* of pernicious anæmia.

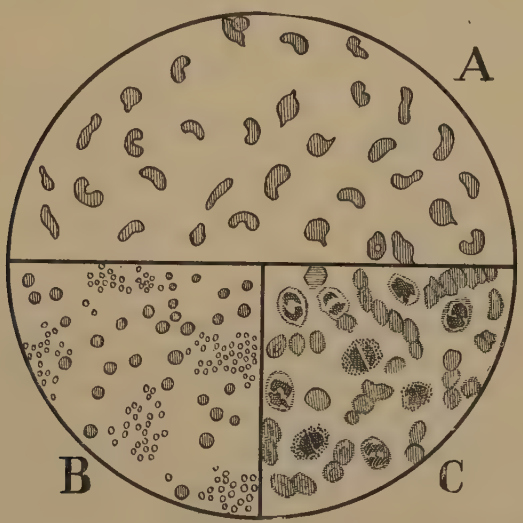


FIG. 238.—Pernicious anæmia: A, poikilocytes; B, microcytes and granules; C, eosinophile cells (Wesener).

Deformity of corpuscles (*poikilocytosis*) is more marked than in any other affection. Elliptical, biscuit-shaped, bottle-shaped, reniform, acuminate shapes appear in connection with very small and very large cells—microcytes, megalocytes. The microscope shows in the pernicious form nothing that may not be seen in other forms of anæmia; but the fact that everything is so much more magnified and distinct is of itself characteristic. The red corpuscles no longer aggregate themselves like piled-up coin, but remain apart, scattered over the field. The white blood corpuscles are really reduced, but in so much less degree than the red as to appear to be increased—relative leucocytosis.

On account of imperfect nutrition, the heart's action becomes

weak; attacks of *palpitation* occur often in the night. Dilatation of the right ventricle sets in, dulness extends beyond the right border of the sternum, the heart's apex is displaced to the left. Auscultation reveals a *systolic murmur* at the base. Anæmic murmurs are also audible over all the superficial vessels, which show visible pulsations. *Hæmorrhages* are frequent from the various mucous membranes. Effusions in the brain may be fatal. Characteristic ophthalmoscopic pictures are furnished by effusions of blood into the retina.

Though insidious in its onset, as the name indicates, the disease is progressive. The blood is robbed more and more of its essential constituents, the body suffers from lack of nutrition, the patient sinks from apathy into stupor, and death occurs suddenly as the result of hæmorrhage, or more frequently in the course of a slowly progressive marasmus.

Since the other signs are common to the various forms of anæmia, the *diagnosis* can be determined only by the condition of the blood. The important factor in diagnosis is the determination of the cause upon which the condition rests. Though occasional glands are swollen, the lymphatic system is not affected.

The *prognosis* is exceedingly grave. The disease is usually, though not of necessity, fatal.

The *treatment* is symptomatic, and, aside from discovery and treatment of the cause, does not differ from that of other forms of anæmia. In all cases of anæmia appeal should be made to the digestive apparatus to secure the absorption of wholesome food. It is sometimes wise to abandon all address to the blood and resort to the stomach tube, with daily irrigations, and to administration of dilute hydrochloric acid, gtt. x.–xv. largely diluted, before meals; of tinctura nucis vomicæ gtt. x.–xx., or tinctura rhei aromatica, teaspoonful, diluted, after meals. The desperate case of Quincke referred to, with a reduction of corpuscles to 143,000, recovered after the practice of transfusion.

CHLOROSIS.

Chlorosis (*χλωρός*, yellow-green).—A disease which occurs chiefly in girls at puberty, marked by anæmia which usually disappears under the use of iron.

Etiology.—Chlorosis is almost limited to the female sex at the period of puberty. It has been exceptionally encountered in childhood and maturity. A rôle of some importance in the causation of the disease is played by heredity, which Virchow explains as a congenital hyperplasia of the vascular system. Other causative influences are emotional disturbances, home sickness, love sickness, bad habits,

night work, loss of sleep, onanism, premature pregnancy, lactation, certain infections, malaria, typhoid fever, etc. The chief cause of chlorosis is connected with some as yet inexplicable disturbance with ovulation.

Symptoms.—The disease begins with a sense of *growing weakness* and easy fatigue. In fact, the feeling of fatigue is much greater in chlorosis, because of the great reduction of hæmoglobin, than in any other form of anæmia. The tendency to sleep is irresistible. Some patients would, if permitted, remain in bed all day. Soon there is indifference; loss of interest; *caprice regarding food*, craving for indigestible, sometimes repulsive things (chalk, sand, slate pencils, mortar), which is secretly gratified; *constipation*, flatulence, *anorexia*, dyspepsia, *palpitation of the heart*, headache, ringing in the ears, wandering pains. *The skin and mucous membranes show a peculiar pallor*, tinted with green, though the dilated blood vessels of the cheeks often leave a red incarnation, the so-called chlorosis rubra, which may confuse the diagnosis (Weiss). Fluctuations of temperature, apparently without cause, dyspnœa, transitory œdema about the ankles and eyelids, occur, as in cases of other anæmia.

The blood is pale, and, while the corpuscles are but little reduced, *the hœmoglobin is reduced one-half*, a disproportion characteristic of chlorotic blood. Alterations of form (poikilocytosis) occur in but slight degree. In consequence of defective nutrition the action of the heart becomes weak, the dulness is increased to be perceived beyond the right border of the sternum. Auscultation reveals *systolic murmurs*, in the order of decreasing frequency, at the pulmonary, mitral, tricuspid, and aortic valves. Menstruation is disturbed in various ways. There is often *amenorrhœa* for months or years, sometimes metrorrhagia.

Bleeding from the nose is not infrequent, is sometimes obstinate. Hæmorrhage from the stomach depends upon ulcer, to which chlorotic patients are especially liable.

The *temperature* is variously affected. Occasionally there is fever without apparent cause. Sometimes the temperature is subnormal. *Palpitation* is frequent and is easily excited. The carotids throb in the neck, and *murmurs* (*bruits de diable*) are to be heard over the bulb of the jugular vein. Thrombosis may occur, especially in the graver forms or after muscular strain. Rendu reported a fatal case from spontaneous thrombosis of the pulmonary artery. The respiratory organs are normal, but the *respirations are increased in frequency, even during rest and sleep*, because of the extra demand for blood, hæmatogenous insufficiency (Eichhorst). *Nervous disturbances*, infinite in variety, characterize chlorosis:

headache, insomnia, paræsthesiæ, hyperæsthesiæ, psychical alterations, caprice, incapacity, apathy, sometimes erotomania, kleptomania, vary the scene.

The *diagnosis* is often difficult at the start, for the gastro-intestinal catarrh, headache, psychical alterations may precede the alterations in the blood and conceal the condition for a long time. The blood changes, when they appear, distinguish the disease from ordinary anæmia. Chlorosis is distinguished from pernicious anæmia by the prompt effect of treatment, and from the œdema of nephritis by the examination of the urine. Tuberculosis must always be eliminated by careful observation of temperature, the use of tuberculin, examination of the sputum and of the chest. Ulcer of the stomach, in the absence of hæmorrhage, may be diagnosticated by hyperacidity, as revealed by the stomach tube, which is often used in the treatment of the gastro-intestinal complications of chlorosis.

The *treatment* consists in the use of iron. The materia medica is rich in preparations. The saccharated carbonate may be administered in doses of gr. xxx.–xl. a day, or the ferrum redactum, in pills, gr. x.–xv. a day. The compound mixture is an efficacious preparation, which may be substituted by the compound pill of iron. A combination of iron with a few drops of Fowler's solution of arsenic is often advantageous. The pill of aloes and iron obviates constipation. The stomach may be toned and stimulated by hydrochloric acid. gtt. x.–xx. in a wineglass of cold water, before meals, and some bitter infusion, condurango, calumbo, absinth, or tinctura rhei aromatica, ʒ ss.– ʒ i. in a dessert- to a tablespoonful of water, after meals. Constipation may be relieved by tamarinds or by cascara in cordial or tablet form. Sometimes it is wise, on account of the condition of the stomach, to abandon all specific treatment for a time and address the stomach directly by irrigation with the stomach tube.

LEUKÆMIA.

Leukæmia (λευκός, pale, αἷμα, blood); leucocythæmia.—A disease characterized by reduction of both red and white blood corpuscles, with the general signs of anæmia. Virchow (1845) first distinguished the affection as a separate disease dependent upon the relative increase of the white blood corpuscles. The normal proportion of white to red corpuscles is 1 : 300 or 1 : 400. Leukæmia may show in a light case a ratio of 1 : 40 or 1 : 30; in a marked case, 1 : 10 or 1 : 5; in the worst cases, 1 : 2 or even 1 : 1.

Leukæmia leads always to enlargement of the blood-making organs, especially to the organs which stand in close connection with the white blood corpuscles, the spleen, the lymph glands, and the marrow of bones. The increase in size depends upon hyperplasia.

It is sometimes very extensive. The spleen may reach to the umbilicus; the lymph glands form tumors in the neck, axilla, and groins, as large as an egg; the medulla may actually distend and disrupt bones. The attempt has been made to distinguish forms as lienal, lymphatic, and medullary, according as affection of one or the other organ or tissue assumed prominence. But mixed forms are so common as to invalidate conclusions. Other organs besides those mentioned, the liver, kidneys, skin, mucous and serous membranes, undergo hyperplasia or contain secondary deposits.

Etiology.—The cause of the condition is unknown. The disease is more frequent in men, and between the ages of thirty and fifty, though it has been observed in children. Leukæmia has been found to develop after malaria, syphilis, tuberculosis, rickets, under depressing mental emotions—anxiety, apprehension, grief—and in the course of exhausting discharges. Sometimes it develops without discoverable cause. The disease is regarded as a chronic infection from unknown cause.

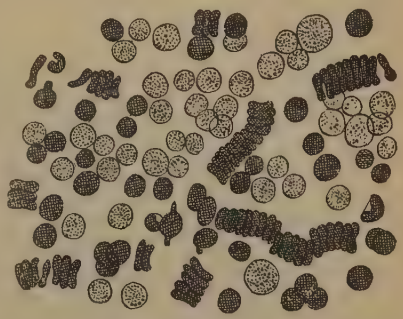


Fig. 259.—The blood in leukæmia, showing the disproportion of the white and red corpuscles. Nummulation perfect.

Symptoms. — The symptoms are the same as those already described in connection with other forms of anæmia. There are *pallor of the skin and mucous membranes, palpitation of the heart* with the development of *murmurs, shortness of breath* upon the slightest exercise, *early fatigue*, alterations of disposition, disturbances of vision, *fever without apparent cause, epistaxis* and other hæmorrhages. In the course of time the disease, which has expended its main force in one or the other of the various organs—the spleen, the lymph glands, and the bone marrow—extends to involve other organs, so that leukæmia is progressive.

The *diagnosis* is not difficult. The signs of anæmia are attended with distinct enlargement of the spleen and lymph glands. In advanced cases the most superficial observation shows the disproportion between the white and red blood corpuscles. The Charcot crystals, described with the sputum of asthma, are found free in the serum and incorporated in the white blood corpuscles. They are most abundant in the bone marrow, and may be seen in blood freshly drawn from the spleen. Leukæmia is distinguished from leucocytosis by the progressive character of leukæmia. The presence of eosinophile cells speaks in favor of leukæmia.

The *prognosis* is very grave. The tendency is progressively downward.

Treatment is almost hopeless. Quinine in large doses sometimes arrests the progress of the disease, more especially in the beginning. Arsenic has no effect upon it. Local treatment of the spleen is of no value. Extirpation of the spleen only aggravates the condition. Mosler, who had a large experience with leukæmia, recommended quinine, piperin, and the oil of eucalyptus in its treatment. Thus :

℞ Quiniæ hydrochloratis.. ..... 2.0
Piperini..... ..... 5.0
Olei eucalypti e foliis..... 10.0
Ceræ albæ..... 6.0
M. Fiat pilulæ No. 100. S. Three pills two or three times a day.

Hoffmann saw no good from inhalations of oxygen, but found

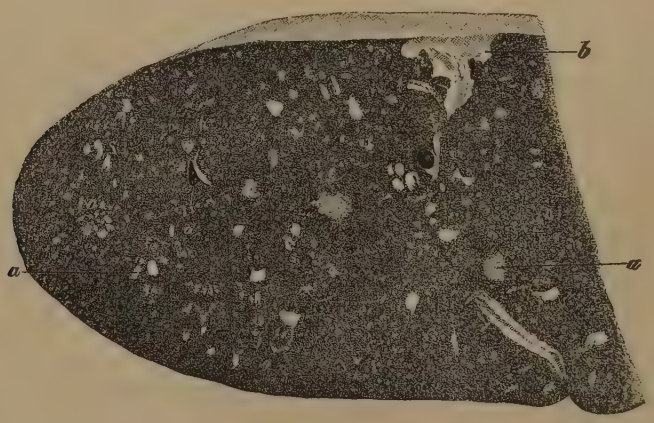


FIG. 260.—Hypertrophy of spleen in lienal lymphatic leukæmia : *a*, white lymph nodules; *b*, yellow ischæmic infarct. Natural size, child.

virtue in douches and cold frictions over the spleen. Mosler recommends transfusion. Surgical intervention is absolutely to be condemned, as of twenty cases of extirpation of the spleen but one escaped with life.

PSEUDO-LEUKÆMIA, anæmia splenica, Hodgkin's disease, is a sub-variety of leukæmia, distinguished by enlargement of the spleen and lymph glands, without, or with but slight, increase of the white blood corpuscles. The disease is essentially the same, save that the progress is much less rapid, arrest with temporary improvement, and actually recovery, more frequent.

The treatment does not differ from that of leukæmia. It is claimed that the injection of arsenic into the substance of the spleen and lymph glands is sometimes of value.

THE HÆMORRHAGIC DIATHESIS.

The hæmorrhagic diathesis is a disposition to hæmorrhage from capillaries (per diapedesin) or from larger vessels (per rhexin). The hæmorrhage occurs in consequence of trivial accident, break of vessel, or spontaneously without any trauma whatever. The blood escapes with all its elements through rupture of vessels or paretic vessel walls, or by reason of the disintegration of the blood; or hæmoglobin, liberated from the corpuscles and held in solution in the serum, escapes from the blood vessels, especially in the kidneys, to constitute hæmoglobinuria. The diathesis is, as the term applies, general, so that hæmorrhage may occur from any surface. Bleeding from the nose, epistaxis, is most frequent. It occurs spontaneously —*i.e.*, without apparent provocation—is profuse, intractable, occasionally fatal. Sometimes the disposition is local, in which case it shows itself usually only in the nose; next most frequently in the intestine. Bleeding may likewise occur from any mucous membrane, from the mouth, nose, lungs, from the intestine, bladder, uterus. Hæmorrhage may take place also into the various serous membranes and internal organs, including the brain. It shows itself frequently upon the surface in the form of petechiæ, ecchymoses, vibices.

Here belong also the cases of hæmathidrosis, or sweating of blood—a condition which may not be denied, since blood corpuscles have been found in the ducts of sweat glands with an unbroken skin (Tittel), and the celebrated cases of stigmatism, or bleeding from a sound skin, which Lefèbvre alone has actually seen.

The hæmorrhagic diathesis is sometimes inherited, but is usually acquired. When inherited it must be distinguished from hæmophilia, which is transmitted only in certain directions. More frequently the condition is acquired. It shows itself as a sequel to some infection, especially to typhoid fever and small-pox, more infrequently to yellow fever, septicæmia, diphtheria. It belongs to the graver forms of anæmia.

The *prognosis* is serious. Life is usually cut short by hæmorrhage from or in some inaccessible region.

The *treatment* consists in the administration of iron, the tincture of the chloride gtt. xx.–xl., largely diluted; acids, hydrochloric acid gtt. xij.–xv., largely diluted; the tincture of cinchona ʒ i.–ij. four times a day; the syrup of the hypophosphites in like quantity. The nutrition is to be improved, especially by food and fresh air. Hæmorrhage is controlled by rest, the application of ice, the use of tampons. As hæmorrhage from the nose usually occurs from the septum, it may be often stilled by the deep insertion of a roll of cotton

upon a small sound. Aggravated cases necessitate the use of the tampon, introduced by a cânula. Internal hæmorrhage calls for the use of opium, atropine, acetate of lead, digitalis, the subcutaneous injection of ergotin or sclerotinic acid.

HÆMOGLOBINÆMIA occurs in the form of (1) *Paroxysmal Hæmoglobinuria* of adults, characterized by periodical attacks of fever, with nervous disturbance and the appearance of urine stained red with the coloring matter, but free, or almost free, of the corpuscular elements of the blood; and (2) *Congenital Hæmoglobinuria*, which shows itself in the new-born child, usually about the fourth day, with vomiting and diarrhœa, icterus, cyanosis, and urine stained with the coloring matter of the blood. Some of the cases undoubtedly belong to the disease generally described as icterus neonatorum.

PURPURA.

Purpura; morbus maculosis (Werlhof).—The condition appears in two forms, as purpura simplex and purpura hæmorrhagica.

PURPURA SIMPLEX is a hæmorrhagic diathesis limited to certain parts of the body, especially to the lower extremities, of little or no gravity. It shows itself most frequently on the legs as petechiæ, which sometimes unite to form larger exudations, ecchymoses. Purpura is observed occasionally in the course of the graver infections, especially in patients who get about too soon. More commonly the disease is spontaneous, occurring often without known cause in the midst of apparent health. It shows itself more frequently in the young, and rather more frequently in women. Subjects of it are liable to frequent attacks. The outbreak is sometimes preceded by light fever. The spots usually fade away gradually and disappear in the course of a week or ten days.

PURPURA HÆMORRHAGICA is the graver form, found in connection with hæmorrhage elsewhere, as with epistaxis, hæmatemesis, hæmaturia, sometimes with evidences of hæmorrhage of serous membranes and internal organs. Both forms may be attended with pain in the joints—purpura rheumatica. Where the joint affection assumes prominence the disease is sometimes distinguished as peliosis rheumatica (πελιός, black and blue). The possible existence of endocarditis (embolus) must not be overlooked in these cases. Certain snake bites produce a typical purpura.

The *prognosis* of purpura simplex is favorable, of purpura hæmorrhagica exceedingly grave. Purpura hæmorrhagica occurs in a fatal form of variola, the so-called purpura variolosa.

The *treatment* does not differ from that of general hæmorrhagic diathesis.

HÆMOPHILIA.

Hæmophilia is a hæmorrhagic diathesis which is transmitted by heredity.

History.—The condition was first described by an Arabian physician, Alsaharavi, Cordova (A.D. 1100), who recognized it as a disposition to obstinate and uncontrollable hæmorrhage in the males of certain families. With the exception of isolated cases by Benedictus (1525), Hoerchstetter (1635), published by Virchow, and a third by Banyer (1743), the disease is not further mentioned in medical history until by Otto, of New York, in the record of a bleeder family in which the disease could be traced back for nearly a hundred years. Other cases of families similarly affected were soon reported in this country. Nasse published the first monograph in 1820. Grandidier succeeded in collecting six hundred and fifty authenticated cases in two hundred and nineteen families up to 1872.

Etiology.—The disease is transmitted chiefly by mothers to sons, in whom the fully developed form is twelve times more frequent than in daughters. Males who are thus bleeders do not, as a rule, transmit the disease ; but females, the offspring of bleeder families, without being themselves bleeders, beget children some of whom suffer or show pronounced hæmophilia. Various causes have been assigned for this condition—lack of fibrin or of fibrinogenous elements, superficial and vulnerable course of blood vessels, thin walls of vessels, etc. Nothing definite is known.

Symptoms.—The condition is usually accidentally discovered : a trivial lesion is followed by profuse, protracted, sometimes uncontrollable hæmorrhage. The scratch of a pin, the extraction of a tooth, the operation of circumcision, the application of a leech, vaccination, excite a dangerous hæmorrhage.

Diagnosis.—Hæmophilia is distinguished from the hæmorrhagic diathesis by the fact that it is hereditary, that it occurs in the male child, or that in either sex it has been observed in the earlier years of life. Spontaneous hæmorrhage is much more frequent in the hæmorrhagic diathesis.

The *prognosis* is grave. In most cases life is cut short by uncontrollable hæmorrhage.

The *treatment* consists, essentially, in prophylaxis, in the avoidance of accidents, operations, etc. Surface hæmorrhage may be controlled by compression, which must be unusually long sustained. Hæmorrhage from the nose may be checked by the tampon; hæmorrhage from the lungs by the subcutaneous injection of ergotin or sclerotinic acid; hæmorrhage from the bowels by the acetate of lead, half a grain to a grain every two hours ; hæmorrhage from the ute-

rus is best controlled by the insertion of tampons of iodoform gauze; hæmorrhage from the mucous membranes and internal organs by the use of cold and styptics, ice, iron, iodoform. Manteuffel declares that the parenchymatous injection of a solution of cocaine, 0.5 per cent, into the gums will always temporarily arrest hæmorrhage from this source by contracting blood vessels, and that the application of what he calls zymoplastic matter, a substance derived from the blood itself, will arrest it more permanently. The nutrition is to be improved in every way with cod-liver oil and iron, food and fresh air.

SCORBUTUS.

Scorbutus (low Latin); scurvy (from *scurf*).—A general disease, characterized by cachexia, characteristic affection of the gums, hæmorrhagic diathesis, and marasmus. Scurvy is a disease which stands in close relation to the character of the food, especially with the absence of fresh and vegetable food. Improvement in the conservation and transportation of foods has led largely to its extinction. The disease prevailed in epidemic form from the fifteenth to the eighteenth centuries and in special severity in prisons, workhouses, and barracks. Scurvy was a constant disease of sea life; a very long voyage was attended with the loss of a number of men. The disease still prevails under similar conditions, as in Paris during the siege of 1870 and 1871, where scurvy assumed epidemic proportions.

Etiology.—Scurvy is distinctly connected with defective nutrition, whether in quantity or quality, though the exact relationship of this factor has not yet been established. Crowd poisoning, exhaustion, anxiety, nostalgia, cold, lack of sunlight, hæmorrhage, chronic disease, malaria, tuberculosis, gastric catarrh, anything which tends toward inanition, predisposes to the disease. Scurvy is probably an infection, but there is as yet no other proof for this statement than the character of the symptoms.

Symptoms.—Scurvy begins with *debility*, which manifests itself in early fatigue, rheumatic pains in the loins and legs, and is soon associated with the pallor and depression of spirits which belong to a *cachexia*. Scurvy may not be distinguished in this regard from other cachexias until a characteristic appearance shows itself in the mouth. The *gums are swollen* by infiltration with serum and blood. The color changes from red to dark blue; the spongy tissue easily bleeds, and the loss of substance shows ulceration and necrosis, sometimes with deep destruction of tissue. The surface is covered with débris and detritus of excessively fetid odor. The breath is defiled. The swelling of the gum confines itself to the region of the teeth. Toothless places remain unaffected. Scurvy soon shows the imprint of the general hæmorrhagic diathesis. Spots of *hæmorrhage*, pe-

techiæ, purpura, appear upon the skin, sometimes as papules, lichen scorbuticus, vesicles, bullæ, pemphigus or linear streaks, vibices. Extravasations occur also in the deeper structures, especially in the lower extremities at seats of pressure or injury. Free hæmorrhage occurs from the various mucosæ, from the nose, bronchi, stomach, intestines, bladder, etc. The serous membranes are likewise attacked. Extravasation occurs in the pleura, pericardium, into the joints, and the various inflammations which may occur show a hæmorrhagic character. Tissues thus infiltrated are easily broken down to suffer extensive ulceration and destruction. As the general weakness increases the action of the heart is weakened, its diameters are increased, and systolic murmurs may be heard at the base. The pulse becomes frequent and feeble. Œdema develops at the ankles. Attacks of syncope are common.

The *diagnosis* rests upon the history of a cause, upon the cachexia and hæmorrhagic diathesis, but is really determined by the peculiar condition of the gums.

The *prognosis* is always serious, and depends largely upon the strength of the individual, the surroundings of the patient, and the stage of the disease. It is more favorable at sea because of the fresh air, at least.

Treatment.—The better means of food supply shows its effect in the diminution of scurvy, which is on the road to extinction. The treatment is a continuance of the means of prophylaxis—viz., the administration of an abundance of fresh food, and especially vegetable food : fruits—oranges, lemons, apples, etc.; vegetables—onions, lettuce, radishes, cabbage, sauerkraut, spinach ; greens—dandelions, etc. Fresh meat itself may be transported packed in ice or may be substituted by the various extracts of beef. The mouth must be disinfected with washes of peroxide of hydrogen, creolin, one-half of one per cent solution, and the spongy gums directly treated with solutions of nitrate of silver one per cent, tannin in some form, as in the tincture of kino, catechu, preferably the tincture of myrrh. A fine remedy for protection and preservation of the teeth is the preparation of thymol devised by Thomas. The mouth should be first thoroughly washed with soap, with care that the brush penetrate to all crevices of the teeth, and thereupon with the following solution :

℞ Thymol	0.25
Acidi benzoici	3.00
Tincturæ eucalypti	15.00
Alcohol	100.00
Spiritus menthæ piperitæ	0.75

M. Add a sufficient quantity to a glass of water to make it milky. S. Use twice a day.

This preparation kills all bacteria of the mouth within one minute. The mouth should also be rinsed out with a three-per-cent boric-acid solution after each meal.

Thymol is the best remedy in the treatment of a sensitive pulp cavity from any cause, or in any kind of caries, and is destined soon to substitute the dangerous arsenical pastes.

The aniline preparations, methylene blue 1 : 100, penetrate deeply and purify. The strength must be supported by the judicious use of stimulants, the appetite increased by dilute hydrochloric acid gtt. xij.–xv. in a wineglass of water, dilute phosphoric acid gtt. xv.–xxx., nux vomica gtt. x.–xx. in a tablespoonful of water. The marasmus is met by malt extracts, especially incorporating cod-liver oil ten to forty per cent.

MORBUS ADDISONII.

Addison's disease ; Bronze Skin disease.—An affection of the suprarenal capsules, distinguished by a peculiar discoloration of the skin, progressive cachexia, and marasmus.

History.—Schötte (1823) and Bright (1831) reported cases of this affection, which were, however, only distinctly separated by Addison (1855). Ranking and Taylor (1856) reported the first cases in this country.

Etiology.—The disease is rare. Males are twice as frequent subjects. The majority of cases occur between the ages of twenty and forty. It has been noticed to follow injuries. The cause is assumed to be a degeneration of the suprarenal capsules, which may be independent as a fibroid change, but is more frequently dependent upon tuberculosis as a caseous change. The condition of the suprarenal capsules has been also considered as an effect of disease of nerve ganglia, especially the plexus cœliacus. In certain cases the suprarenal capsules have been found to be affected with carcinoma.

Symptoms.—The disease is said to stand upon a tripod of symptoms—to wit, *discoloration of the skin, progressive anæmia, and degeneration of the suprarenal capsules.* Any one of these conditions may be present or absent in certain cases. Addison associated with these symptoms general languor and debility, feebleness of the heart's action, and irritability of the stomach. The discoloration assumes a *bronze, that is, a greenish-brown,* tint, but varies in shade from light yellow to dark brown or black. The pigment is deposited in the deeper layers of the rete Malpighi. Sometimes it is diffused, but is usually most marked on the surfaces naturally most deeply pigmented—nipples, scrotum, penis. For obvious reasons it is first seen in the face. The various mucosæ are also discolored; spots are

seen upon the lips and cheeks. The vagina is often deeply tinged. The serous membranes have been found bronzed. The sclera usually escapes. The bed of the nails remains white. The discoloration usually comes on later in the history of the disease, and is preceded by a period of *debility*. Anæmia and cachexia gradually develop, usually without much loss of flesh, and in association with them *anasarca*, *dyspepsia*, *gastro-intestinal catarrh*. Rheumatoid pains are frequent. Symptoms on the part of the nervous system are prominent. Languor increases to depression; in the later period of the disease there are sopor, delirium, convulsions, and coma. Patients succumb slowly to marasmus, sometimes suddenly to heart failure.

The pathogeny is obscure. All attempts to locate the origin of the disease in the suprarenal capsules would seem to have been nullified by the experiments of Nothnagel, who found no changes in one hundred and fifty-three animals after total extirpation of these bodies. On the other hand, Lewin found actual tuberculosis of the adrenals in two hundred and eighty-five of three hundred and seventy cases, and in the remaining eighty-five cases no disease of these organs It is therefore not improbable that other affections have been included under the term Addison's disease, and that the malady *pur et simple* is, as Addison declared, a degeneration of these bodies. Brown-Séquard long ago ascribed to the suprarenal bodies the function of converting pigment into colorless matter. The failure of the symptoms after extirpation of the adrenals may be explained by the fact that the animals were not kept long enough, as Tizzoni found that in rabbits kept alive two and three-quarter years after crushing of the adrenals similar pathological pigmentation developed with multiple degenerations in the spinal cord.

The *diagnosis* rests upon the train of symptoms mentioned: the asthenia, discoloration, gastro-intestinal catarrh, progressive cachexia, anæmia, and marasmus. The presence of no single factor, not even the discoloration of the skin, is necessary to a diagnosis. The disease must be distinguished from the discolorations caused by tumors in the abdomen, pregnancy, disease of the uterus and liver, chloasmata, as well as from that deposit of pigment which occurs in connection with pediculosis and from the peculiar discoloration of nitrate of silver. The lack of associate symptoms suffices to make a diagnosis.

The *prognosis* is fatal. The disease lasts from a few weeks to several years. The average duration of life is a year and a half. The course is longer, and to this extent the aspect more favorable, in cases where the bronze discoloration is most pronounced. Recoveries are considered proofs of mistake in diagnosis.

The *treatment* does not differ in any way from that of anæmia and cachexia from other cause. Rest of body and peace of mind, with favorable hygienic surroundings, may materially prolong life.

GOUT.

Gout (*gutta*, a drop).—A disease caused by the instillation into the joints of uric acid ; characterized by pain in paroxysms—first in the big toe, later in other joints—later by deformities of the joints, affection of the heart and kidneys (atheroma), and marasmus.

History.—Gout is a disease of ancient recognition, though the term itself is comparatively modern. It was known at the time of Hippocrates as "podagra," and prevailed with such frequency in the opulent days of Rome as to have attacked women as well as men. Lucien named one of his characters Podagra. The term gout dates from the days of humoral pathology. It has an origin of the same significance as rheumatism and catarrh, in that the peccant humors which float about in the blood come to be distilled, drop by drop (guttatim, *gutta*, a drop), into the joints.

However much our views of disease processes have changed since the days of humoral pathology, gout still holds its place as the distillation of an acrid humor from the blood. While all the other diatheses have failed and fallen to the ground, the gouty diathesis remains. An increase of uric acid in the blood, a deposit of uric acid in the joints, from kidney fault (Garrod), from local cause (Ebstein), constitutes the pathology of gout. This discovery, due to Wollaston (1798), constitutes the keystone of our knowledge regarding gout. All other theories must conform to this central fact. It was Sydenham who first separated gout from the rheumatisms. The graphic descriptions of Sydenham were founded upon not only personal observation, but personal experience ; and the fact was noticed by him as a matter of comfort that individuals of the upper rather than the lower class are the victims of this disease. "Great kings, emperors, generals, admirals, and philosophers have all died of gout," which, "unlike any other disease, kills more rich men than poor, more wise men than simple." In our day this fact is a poor consolation, for it is, as Fagge says, robbed of its virtue, because life-insurance examiners put a higher premium upon, or absolutely refuse insurance on, the lives of gouty patients.

Etiology.—Gout occurs for the most part in the latter period of life, with increasing frequency from forty to sixty ; exceptional cases at sixteen and eighteen have been put upon record, such cases also at eighty, but the disease rarely originates after sixty-five. Cases in advanced life are survivals. Gout is a hereditary disease. Statistics of the most competent observers—Garrod, Scudamore—put

the proportion at from one-third to one-half. It has been remarked that the eldest members of the family suffer more uniformly and more severely, as the younger members, observers of the sufferings of the disease, refrain from excitants to some extent.

Gout is a disease of high livers, of rich animal food with abundant libations of alcohol, of food more especially which is highly seasoned, of wines with rich aroma. So gout may attack the young. It may also attack those who are more advanced in age, even though of abstemious habit, through heredity—sometimes as the only inheritance, the fortune having been spent in its acquisition. Workers in lead, more especially plumbers, painters, and printers, are predisposed to gout.

Uric acid injected into the blood in health is speedily converted into urea and eliminated. The excretion of uric acid varies in health between three and fifteen grains per day, and is subject to much greater variation with changes in diet, exercise, etc. It is therefore difficult to establish estimates of quantities which will produce disease. Nevertheless Pfeiffer ascertained by careful measurements, taken with every possible precaution, that patients with acute gout excrete more, and patients with chronic gout less, uric acid than in health. Rich foods, especially the albuminates, in excess, overload the blood with acids and diminish its alkalescence, a condition which favors the conversion of the urates into urea.

Symptoms.—The attack occurs for the most part suddenly. The patient retires in his usual health, sometimes with exaltation of spirits, more frequently with more or less depression, the result of dyspepsia with its train of distress, and is awakened in the night, between midnight and morning, with *pain localized, as a rule, in the big toe joint.* The pain is at first an uneasiness, soreness; the patient moves his foot about, extends it, withdraws it, protrudes it, in the vain effort of seeking a comfortable position. Sometimes there is a feeling as if tepid water were poured over the joint. There is no finding a comfortable position. The pain increases, becomes excruciating; the patient feels as if the joint were penetrated with hot irons, were twisted, crushed in a vise. The slightest agitation of the room or of the bed, the rumble in the streets, exaggerates it and irritates the patient beyond expression. In the course of half an hour to two hours the pain begins to diminish, sometimes with diaphoresis, sometimes with diuresis. The patient begins to feel that he has at last found a comfortable position, the pain dies away, the patient falls asleep, to be awakened in the morning, after rather protracted sleep, entirely, or almost entirely, free of pain. On inspection of the joint it is seen now to be *reddened, swollen, tender,* limited in its movements. The skin pits upon pressure. The patient

is able to resume his avocation. On the following night the whole condition may reappear, or not for several nights, or a fortnight, sometimes not for months or a year. The interval will depend largely upon the habits, especially regarding self-denial. As a rule the first interval is the longer. The patient profits by the first lesson for a time until indulgence renews the attack. The disease now extends to involve other toes, to affect also the joints of the fingers, to extend afterward to the ankles and wrists; but in however great extent or severity, it never, or almost never, affects the largest joints, the hip and shoulder. As the disease repeats itself more frequently, the attacks become comparatively milder. The interval grows shorter, but the individual attacks are longer. Finally the inflammation about the joints never does entirely subside. Characteristic *deformities* supervene, and with these deformities are associated *chronic gastric catarrh* with its attendant evils, *affections of the kidneys, atheromatous changes, functional and organic heart*

Fig. 261.—Gouty fingers.

affections. The patient now becomes more or less *emaciated, irritable, morose.* On the other hand, in some cases the *bien-être* remains. The florid face from paretic capillaries or acne rosacea, the sluggish circulation, the dull expression, indicate the addiction to high living with its corresponding degradations.

Cases of chronic gout present characteristic *deformities about the joints.* The swelling of the acute attacks subsides often to leave no trace, but as the disease becomes more and more chronic the swelling does not entirely subside; it abates, but does not disappear. The fluctuation gives place to a *doughy sensation,* the matter instilled into the joint becomes thicker and thicker as its fluid elements are absorbed. It becomes also more irritating, breaks the skin, at times to show an *ulcer* or an abscess from whose surface or interior *oozes a substance of mortar-like consistence,* composed almost exclusively of the urate of sodium. These ulcers are exceedingly refractory. They continue to discharge, with quiescent intervals at times, for months or years or for the life of the patient.

As a result of the depositions of this salt into the joint the articulating surfaces are deformed, the joint becomes dislocated; various anomalous positions are thus assumed. A common habitus is that of forcible flexion of the fingers at the second or third joint, with exception of the first. The first knuckle is represented by a depression. Sydenham says the fingers look like a bunch of parsnips. The same alterations occur about the feet, about the toes, and deformities of the wrist and ankles may incapacitate the individual for the needs of life. These tophi, erroneously called chalk stones, occur also, as stated, in any joint distant from the circulation, about the ear, and various portions of the skin, at any one of which an ulcer may form.

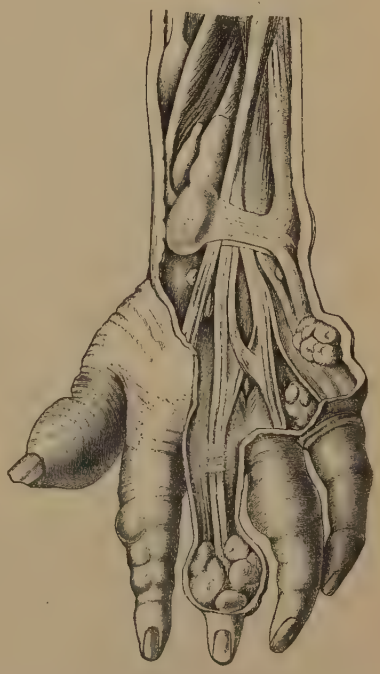


Fig. 262.—Tophi in the joints and tendons.

Diagnosis. — The tendency to gout is indicated by dyspeptic states, pressure at the præcordium, palpitation, numbness of the extremities, with itching and eczema of the skin, neuralgias or pains anywhere, migraine, insomnia, asthmatic attacks. The sudden occurrence of conjunctivitis, iritis, or corneal ulcer betokens attack in some people, and hitherto inexplicable cases of any of these affections become not only intelligible but curable when interpreted as premonitions or prodromata of gout.

Gout is distinguished from articular rheumatism by the fact that it attacks age rather than youth. The history of heredity and high living gives some help. The character of the onset in one joint, especially the big toe joint, is very different from that of implication of multiple joints, more especially medium-sized joints, of acute rheumatism. Gout remains fixed; rheumatism flies from joint to joint. Rheumatism is a disease of indefinite but of shorter duration ; gout is for the most part a lifetime malady. Gout shows much less fever, and the fever in gout is more directly proportionate to the extent of the local inflammation ; whereas there may be in rheumatism much fever with little inflammation, or much inflammation with but little fever. Gout is more especially attended by gastric disturbance; in rheumatism there may not even be anorexia. Gout affects the kidneys and heart with cirrhotic and

atheromatous change; rheumatism affects the serous membranes. Rheumatism yields more readily to treatment, gout more readily to diet and regimen.

Gout distinguishes itself from chronic rheumatism by the fact that gout affects small joints, chronic rheumatism large joints. Chronic rheumatism shows no fever and is unattended with any cardiac or renal changes. Chronic rheumatism is more unamenable than gout to treatment.

The disease which is most frequently confounded with gout is arthritis deformans. The following points draw the lines of distinction: Gout affects most frequently males, arthritis females. Gout chiefly affects the upper, arthritis the lower classes. Gout begins in the toes, arthritis in the fingers. Gout swells and dislocates the joints of the big toe and afterward of the other toes. Arthritis commences by preference in the fingers, which it also swells and dislocates, as a rule in a more regular way, so as to imbricate the joints of the first three fingers, pointing the fingers toward the ulna. Gout, when it affects the hand, does not to the degree of arthritis spare the thumb. The deformities of arthritis are produced by outgrowths of bone; of gout by deposits of sodium urate. So-called cases of rheumatic gout are supposed to represent mixed forms or coincident attacks. The possibility of such a condition may not be denied, but an autopsy decides always in favor of one or the other. In a doubtful case the blood may be examined for urate of sodium. If two drachms of blood serum be slightly acidulated with acetic acid in a watch glass and a linen thread be suspended or laid across the glass, the thread will be found after twenty-four hours covered with crystals of uric acid. Uric acid may also be crystallized out of the fluid of a blister not too near the joint. It is needless to say that this excess of uric acid cannot be detected in rheumatism in any form or in arthritis deformans. It belongs exclusively to gout.

Prognosis.—Gout is in itself not especially dangerous. It is dangerous only in the remote consequences which its persistence may entail. All cases of acute gout recover, and the future of the case depends largely upon the habits of the individual. On the other hand, where the hereditary taint is strong or the conditions of life exclude proper hygiene, where gout becomes chronic, the duration of life is abbreviated by disease of the kidneys, heart, or brain. It may be said, therefore, that the prognosis of acute gout is good, of chronic gout is bad.

The *treatment* depends, first, upon the regulation of life. The sedentary avocation must be changed; the gouty patient should walk, or, better, should ride horseback. Conditions which tend to obesity, sluggishness of circulation, constipation, must be overcome.

The diet should be simple, plain, and homely food. Meat should be taken but once a day, vegetables without rich sauces. Alcohol must be put under ban. The time may come in chronic gout when a glass of Rhine wine or claret may be necessary, but as a rule the best drinks are water and milk. Sydenham lamented that he might not live to witness the discovery of a specific for gout. Not many years after his death a remedy was sold, under the name of Eau Médicinal, which proved of such virtue as to seem almost specific. The active principle of this remedy was discovered to be colchicum, meadow saffron; and colchicum in its alcoholic preparations soon came into general use in the treatment of gout. Watson vaunted its virtue. The remedy was given as the wine of colchicum, gtt. x.–xl. two or three times a day, in association with or followed by a saline laxative.

Mineral waters—the alkaline mineral waters—largely aid the treatment, and sometimes suffice to make a cure without colchicum. The waters of Vichy and Carlsbad, and waters containing lithia, are of especial value. The ordinary Carlsbad salts, containing large quantities of the sodium phosphate, are a remedy justly in general use. A glass of cold water containing a teaspoonful of this salt is taken three or four times a day. After the discovery of the salicylates it was soon found that these preparations had all the virtues without the vices of colchicum. Colchicum in a dose too large, or in a stomach too irritable, produces nausea, vomiting, diarrhœa. The salicylates are not attended with these evils, and choice may be had, with reference to the condition of the stomach, of the salicylate of soda, salicin, or salol. Piperazin is a powerful solvent. It dissolves twelve to fifteen times as much uric acid as lithia. It is given best in tablets, fifteen grains per day, or in large quantities of water (soda water, Vichy, etc.), always in itself a valuable adjuvant. It is especially indicated in cases complicated with gravel or kidney stone. A good fluid preparation is:

℞ Piperazini puri.....gr. xv.
Syrupi aurantii corticis.....ʒ v.
Aquæ destillatæ.....ℨ v.
M. S. The whole quantity to be taken during the day.

The remedy is not injurious in any way in twice or thrice the dose.

Envelop the joints in cotton. All other local treatment is useless. Energetic patients cut an attack short by getting out of bed and going about as soon as possible.

ARTHRITIS DEFORMANS.

Arthritis deformans; rheumatic gout; nodular rheumatism; arthritis sicca; arthritis pauperum; polypanarthritis.—A disease characterized by progressive, symmetrical deformity of the joints.

History.—Arthritis deformans existed from the most remote antiquity. Chiaje, of Naples, saw the deformities in bones exhumed from Pompeii. Lebert described the same changes in skeletons found in the catacombs of Rome, and Virchow in the joints of bodies dug up in an ancient monastery of Pomerania. The old writers considered it simply a form of rheumatism, and Sydenham, who separated gout, was content to relegate this form of arthritis to the rheumatisms. Haygarth, who suffered from it, wrote the first classical description, and the Irish surgeons, Smith, Colles, and Adams, distinguished it from surgical affections of the joints and gave it a separate place.

Etiology.—The disease distinguishes itself by peculiar alterations of the joints, by an affection of all parts of the joint, and also by gradual implication of all the joints. Hence the propriety of the synonym of Hueter—polypanarthritis. Arthritis deformans is a disease of age rather than maturity, though it may occur earlier in people in whom age is precipitated, as by alcoholism, atheroma, etc. Women are the greatest sufferers, and the poorer class, with many exceptions, is oftener affected. The disease sets in in two ways. First, and more commonly, it attacks the smaller joints, with a specal predilection for the joints about the hand, the metacarpo-phalangeal joints ; next, it affects the largest points, the joints of the vertebræ and the hip joint.

In the great majority of cases it commences in the smaller joints ; but, whether it commences in the smaller or in the larger joints, the natural tendency of the disease is to *extend symmetrically* until it involves them all. Various theories have been propounded to account for its origin. 1. The mechanical theory is that the alterations about the joints are due to trophic changes, because of mechanical pressure at the escape of the nerves from the intervertebral foramina. In this explanation it is implied that the bones of the vertebræ suffer first, which is by no means the case, even as a rule. 2. The chemical theory, that there circulates some poison in the blood which expends itself upon the joints after the manner of rickets and lues. 3. The neurotic theory, which implies some affection of the spinal cord, whereby the bones and joints suffer trophic change. Support is lent to this view from the well-known alterations in the bones and joints which occur in certain cases of locomotor ataxia. Charcot, Benedikt, and Remak favor this view. But the changes which occur in locomotor ataxia are more especially absorptive changes affecting particularly certain joints, the hip and the knee, and then in only a very small minority of cases. The evidence in favor of the neurotic theory of the disease is based mainly upon the fact that the disease occurs about the period of degenerative change and that it is distri-

buted over the body symmetrically. The real cause remains as yet unknown.

Symptoms.—Arthritis deformans declares itself for the most part insidiously. Cases have been reported in which, after depressing mental emotion, more especially prolonged sorrow or grief, dejection from financial strain, domestic infelicity, etc., arthritis deformans has developed in the course of a few weeks, but for the most part the disease sets in very gradually. There is noticed, first, *a want of deftness and dexterity* of the movements of the joints, remarked more especially in artisans and mechanics, fine lace and needle workers, piano players, etc. The fingers do not respond; the fine, educated movements, which have become more or less automatic, lag behind. There is *stiffness, more especially noticed in the morning* upon rising from bed, to pass away with exercise of the body; later it becomes more marked and more permanent. Soon—that is, in the course of months rather than weeks—characteristic *deformity* shows itself, in that the metacarpo-phalangeal joints become swollen, tender, stiff. Partial luxation occurs later from the changes in the bones. The fingers are extended and flexed upon the hand, and come to lie over each other, to assume an imbricated arrangement, pointing usually toward the ulna, more exceptionally toward the radius. The position of the hand is now quite peculiar: it assumes something of the position of a *bird's claw* when first lifted from the perch. As the deformity advances more or less complete dislocation of the joints ensues. Other joints of the fingers swell, rendering extension even more pronounced, so that at times the hand has the appearance of being turned over. *Atrophy* sets in in the muscles. The hand is crippled; it is also wasted. All the while, however, as a rule, *the thumb remains unaffected*, and by its range and power makes up in great degree for the loss of movement of the hand, so that the patient is still able to perform many, even delicate, movements.

Strange to say, when the foot becomes involved, which is the case often simultaneously, oftener subsequently to the hand, the big toe is the joint first affected. The metatarso-phalangeal joints become dislocated in the same way as in the hand. The big toe joint is swollen, tender, and stiff—a deformity noticed but little, because the foot is limited by its dress, but noticed on account of the pain from pressure. The shoe pinches, bunions form, the disease then involves other toes, and the nature of the affection is unmistakable. Thereupon it extends to involve the wrist, the elbow, the shoulder, and gradually, in the course of years, more distant articulations. Finally the joints of the ribs, the clavicle, the jaw may be affected, but the disease advances rather by *exacerbation and abate-*

ment than continuously. There are periods of acute inflammation, short in duration, followed by long periods of arrest or quiescence, each exacerbation leaving, as a rule, some, perhaps almost imperceptible, additional lesion. The individual finally becomes hopelessly crippled. He may no longer dress himself, feed himself; the body takes the position of the chair in which it rests. For a time after the individual has lost the power of motion he may help himself with canes, with crutches, with wheeled chairs, to which he finally be-

Fig. 263.—Arthritis deformans. Section of cartilage of head of femur, × 40. *a*, hyaline cartilage; *b*, hyaline cartilage with exuberant cartilage cells; *c*, *c*, abraded cartilage; *d*, clefts in cartilage; *e*, spots of softening; *f*, cartilage cells; *g*, new marrow spaces; *h*, new, *i*, old bone tissue; *k*, old marrow spaces; *l*, osteoclasts (Ziegler).

comes locked, and must be lifted from the chair to the bed, and at last must even have assistance to be turned in bed.

The characteristic feature of the disease is the *deformity*. Irregular changes of all kinds occur in the bones and the joints. Bony outgrowths, exostoses, protrude about the joint to cause dislocations, to swell the heads of bones, to obliterate cavities. Exacerbations make new cavities. Striations occur from friction; sometimes such stimulation as to harden the bone to produce eburnations. Harden-

ing and softening go side by side, eburnations and porosities, until at last the natural outlines of the bone are almost wholly destroyed.

The cartilages suffer in the same way, now in certain places, now in others. The capsules, the tendons, finally the muscles which move the joints, become atrophied from disuse, so that in extreme cases the individual presents a characteristic appearance: the body is more or less emaciated, the joints are locked. Atrophic conditions occur also in the skin, and sclerodermatous patches, more particularly surfaces of glossy skin, are not uncommon. All the while the sensorium is unaffected, the digestive system may remain unimpaired, the respiratory apparatus unattacked, the heart's action unaffected. For the most part, however, patients become, on account of their sufferings, irritable; there is a tendency to *hypochondriasis;* there is *constipation;* there is more or less *impairment of the appetite and digestion*, yet appetite and digestion continue to suffice for the reduced wants (motions) of the body.

Diagnosis.—The disease is distinguished from *acute rheumatism* by the fact that it attacks the aged, and more especially the female sex; that it remains fixed in the joints which it attacks, and produces permanent deformities; that it is unattended with sweating, with fever, except in the acute complications, and with cardiac disease. It is distinguished from *chronic rheumatism* by the affection of so many joints, chronic rheumatism being confined to one or a few; by the attack of the smaller joints; by the peculiar deformity it produces in the smaller joints; by its universality. Distinction from gout, which it most closely simulates, has been described under gout.

The *prognosis* quoad vitam is good; most patients die of old age. Haygarth wrote his description of his own case at eighty. The prognosis quoad valetudinem is bad, in that in the great majority of cases the disease is permanent. It may be controlled, but not cured.

Treatment must be general rather than local: warm baths, travel, sojourn in the South in winter, in the North in summer—*i.e.*, ability to pick the climate in which the individual suffers least, as in the pine regions (Georgia, the Carolinas), on islands (Nassau), in the mountains, Virginia, Maryland rather than Colorado, or somewhere in the varied climate of California. Locally the progress of the disease may be stayed by gentle friction, massage. Flying blisters in the more chronic cases are often of value. Electricity, the galvanic current more especially, is of occasional service. As to drugs, the most good is accomplished by arsenic. Small doses are to be given over a long time, that the action of the remedy may be sustained. Iodine has long had a reputation, more, really, than it deserves. It was first used by Lasègue, Trousseau's assistant, in the form of the tincture, ten drops three times a day, but is best

administered in the form of iodide of potassium or sodium with milk, in small doses long continued. Salol, the salicylates, salipyrin, have over the acute exacerbations the quickest control. Phenacetin may suffice to control pain.

RACHITIS.

Rachitis; rickets.—A disease of childhood, seven months to seven years, characterized by disturbance of digestion, bronchial catarrh, with characteristic changes in the skull, chest, and bones of the extremities.

History.—Glisson, a distinguished anatomist and physician of the seventeenth century in England, called this disease rachitis partly because of the popular name rickets for a disease marked by deformity of bone, and partly in deference to the Greek word *rachis* (ῥάχις), the spine, because of the distortions produced in the dorsal chest. The disease had long been known by the people and had attracted the attention of physicians, more especially of the counties of Devon and Somerset, in England. A prominent English physician, Whistler, described it as a disease of English children, and Continental writers took it up as an English disease, though the changes characteristic of it had been recognized in bones almost from time immemorial, and are perpetuated in one notable statue, that of the famous Æsop.

Etiology.—It is difficult to assign rickets to its proper place in nosology. On account of the prominence of the bone deformities, especially in the neighborhood of the joints, the disease is generally discussed along with the rheumatisms. Because of the general disturbances which precede and accompany it, it is sometimes given a place by the side of tuberculosis and lues. The tendency in our day is to put it among the chronic infections of the blood by the side of tuberculosis and syphilis.

Inasmuch as most of the main deformities of the disease can be accounted for by the softening of the bones, it was early supposed that rickets resulted from an insufficiency or a reabsorption of the lime salts. Chossat and Milne-Edwards withheld the lime salts from young animals and observed marked deformities in the build of the bones; but Friedleben, who repeated all these experiments, observed that while these deformities do occur, they are evidence rather of malnutrition and are not the characteristic deformities of rickets. Guérin advocated the theory of malnutrition, and he, too, proved it by withdrawing young animals, puppies, from their mothers and feeding them with meats. Here too, however, the changes which occurred are to be ascribed, according to Tripier, to malnutrition and not to rickets. Wegleben declares that if phosphorus in small quan-

tities be administered to animals from whose diet the lime phosphates are withheld, changes occur exactly like those of rickets.

Bone Changes.—These changes affect chiefly the ends of the bones. They grow larger to such degree as to overlap the joints as if by condyles. This development gives the appearance of the double joint which the disease is sometimes called. The enlargement is most observed where bone unites with cartilage, and is seen in most distinctive form at the junction of the ribs with their cartilages. Thus a line of nodules may be traced downward and outward from the first through the successive ribs to constitute what is known as *"the rosary," or the beads of the ribs.* Elsässer (1843) contributed an important fact to our knowledge of rickets in the observation that the bones of the skull, especially *the occipital bones, become softened in places.* The condition is recognized by palpation of the head with the whole hand, with alternate pressure of the fingers, whereby spots of softening, the so-called craniotabes, are recognized, especially about the lambdoidal suture. Rickets shows characteristic deformities in the shape of the skull. The fontanelles close late, sometimes not until the end of the second or third years. The head fails, therefore, to assume its natural ovoid shape. It is flat on top, the frontal eminences protrude, the eyes seem sunken. It is claimed that the precocity of rickety children is due to the easier expansion of the skull. Fagge says this fact, if it be a fact, is more readily explained by the confinement to the house of these children, their closer association with adults, and, we might add, more constant resort to books. The skeleton of rickety children is always short, hence *the stature is diminished.* Most dwarfs are victims of rickets. Of all the specimens examined by Ritterhein, but one came up to the normal standard. The bones of the face are also arrested in development. *The face seems a mere appendage* to the enlarged head. The jaw is narrow. Dentition is late ; the teeth, stunted, imperfectly covered by enamel, decay early. On account of the softening and elasticity of the bones of the ribs the antero-posterior diameter of the chest is increased. The sides are flattened, the sternum protrudes to constitute what is known as "the pigeon breast." The great glands, the liver and spleen, sink or are pushed below the level of the ribs to give undue prominence to the abdomen. The pelvis is deformed so that its conjugate diameter is shortened ; or other deformity ensues from pressure, as in support of the child upon the arm of the nurse, or even from long-continued decubitus. The bones of the arm yield outward, as do also the bones of the legs, to such a degree as to constitute what is known as bowlegs. Most of the aggravated cases of bowlegs in children are due to rickets. Rickety bones also are apt to break, especially with a vitreous or

green stick fracture. Serious changes take place also in other organs of the body.

Symptoms.—Rickets announces itself for the most part by symptoms which may antedate the deformities of bone by weeks or months, to such degree often that the early recognition of the disease may prevent or limit subsequent changes. Thus disturbances of digestion, *anorexia, diarrhœa, constipation*, or disturbances of the respiratory tract, *catarrhal affections and cough*, may precede more distinctive symptoms for several weeks or months. The symptoms may simulate the advent of tuberculosis, basilar meningitis, and all the more from the fact that the ages affected are about the same. It is soon noticed that the rickety child is *restless at night*,

1 2

FIG. 264.—Deformities of rickets. 1, thigh of adult with rachitic deformity of diaphysis; 2, thigh of adult with rachitic deformity of lower epiphysis.

kicks off the covers, tosses about the bed uneasily, in marked contrast with its former quiet state.

A symptom of more value is *sweating*, which occurs without provocation, which is not to be accounted for by the heat of the weather or by bedcovers. The sweating is all the more readily recognized because it attacks more especially the head and neck—exposed parts of the body. It is observed also that rickety children are *sensitive to pressure* and to manipulation. They do not relish being fondled, dandled on the knee, or tossed. It is plain to see that any rough manipulation gives pain. The observance of any of these conditions—restlessness at night, sweating of the head, sensitiveness

—should excite the suspicion of rickets, which may be confirmed or refuted by examination of the bones. Rickets often announces itself so insidiously as to be preceded by no observable change, so that the disease becomes manifest only with the deformity of bone.

On the other hand, the existence of the disease in even advanced or rapidly advancing, and still unsuspected form, is made manifest at times by a violent spasm, more especially a *larynyospasm*. Spasm of the larynx belongs in nine-tenths of cases to rickets. The spasm occurs suddenly, in the day or night, as the child awakens from sleep, as it is moved, lifted, as it is carried, as the light is admitted to the room, as it is fed, on the approach of the spoon, as it is being examined, in some contact with the throat. Suddenly the glottis closes, and is held closed so that no air whatever enters the chest. The spasm may extend from the glottis to involve the muscles of the neck and jaws, or, indeed, of the whole body to present the appearance of tetanus. Such spasm is well to be distinguished from the spasmodic closure of the larynx in laryngismus stridulus, or false croup, where air may still enter with a long-drawn, stridulous, or crowing sound like that of true croup. In the croup case the closure is partial; in spasm, complete. False croup yields to a hot bath, to bromides, or to an emetic—remedies which cannot even be brought to bear in the treatment of spasm of the larynx in rickets.

The *diagnosis* is easy if the existence of the disease be suspected, but is confirmed only by the presence of the characteristic changes in the bones.

Prognosis.—Rickets is a disease which, undisturbed, runs a long course. It terminates spontaneously usually about the end of the second, sometimes not until the sixth or seventh year, but may be cut short, as a rule, in a few months by proper treatment. It has in itself no mortality. Fatalities are from complications—spasm of the larynx, true croup, bronchitis, pneumonia, etc.

Treatment.—While it may not be said that malnutrition is the essence of rickets, it is certainly true that in most cases errors of diet can be discovered. Sometimes the child is weaned too soon, sometimes it is nursed too long, more frequently it is fed prematurely upon starchy food or meats, eggs, etc. That these dietary errors are insufficient to cause the disease is proven by the fact that many children of the poor, under the grossest errors of diet, escape it. Rickets is almost unknown in high altitudes and in the polar regions, places where children are fed in the coarsest way. It is, however, true that the error of diet acts as an excitant to the cause of the disease, whatever it may be, and that correction of this error plays an important rôle in treatment.

Where the child may not be nursed by its mother, a wet-nurse

should be obtained; but where this is not possible, as it is not possible in the rule, a child should be fed with cow's milk properly diluted, or, if older, the diet must be regulated with a proper selection of meats, vegetables, and fruits, especially oranges, lemons, and grapes, later apples and cherries. Green things are essential in the treatment of rickets. Erroneous postures must be relieved. Nurses are to be enjoined to change the decubitus from side to side, and not to permit too long repose upon the back of the head. Mattresses and pillows should be soft. So, also, injunction should be entered as to the mode of carrying children, that the bones of the pelvis be not too much compressed. Rickety children are to be restrained in efforts at early walking, or traction with the hands, that bone deformities be limited or prevented. After the bones become hard in the further course of the disease, these methods are of no avail. Resort must be had in extreme cases to exsections, more especially wedge-shaped exsection of bones, in the correction of extreme deformity. Cod-liver oil holds a place between a food and a drug. It is administered best pure in tea- to tablespoon dose after each meal. It certainly contributes largely to the relief of rickets. Iron may be a valuable remedy, as also arsenic, in selected cases; but the agent upon which most reliance is placed, which acts nearly as a specific in the treatment of rickets, is phosphorus. To Kassowitz is due the debt of this discovery. Lime phosphates and other phosphates had been administered for years in the hope of relieving rickets, but without avail. Phosphorus is of value only when it may make its own compounds or select its own basis in the body. It is best given, therefore, pure, in the form of an emulsion with almond oil, olive oil, or preferably cod-liver oil.

℞ Phosphorus ..... gr. ⅛.
Olei morrhuæ ..... ʒ ij.
M. Fiat emulsio. S. Teaspoonful three times a day after meals.

Laryngo-spasm is most efficaciously treated by cold affusions. There is no possibility of the administration of an anæsthetic, as the child cannot breathe until the spasm is over. Cases liable to laryngo-spasm should be treated with the consideration of cases of tetanus and hydrophobia, with reference to outside irritation. The dress should be open. The child should rest upon an oil-cloth or rubber cover, that the garments may be quickly removed, and the face, chest, and neck douched with cold water. Muth says he recovers his worst cases by inflating the lungs through a catheter—a process that might be better accomplished in our day by intubation. Such intervention is, however, really superfluous. Nearly all cases recover with time under the general treatment of the disease.

Osteomalacia is a disease of adult bones, characterized by absorption of already deposited lime salts with corresponding softening and deformity. It occurs especially in fertile women in pregnancy, hence at the age of twenty to fifty, and is announced by pain in the bones, early fatigue, nervousness, muscular tremor, and twitching. Treatment is the avoiding of pregnancy, securing the most favorable hygiene, and administering lime salts, phosphorus, and cod-liver oil.

OBESITY.

Obesity (polysarcia, corpulence) is an abnormal increase of fat. The condition may be acute or chronic, but usually develops slowly. The amount of fat which may be consistent with health varies in different individuals, and in the same individual at different periods of life. People gain and lose weight, which is largely a matter of the amount of fat, within certain but indefinite limits, without interference with comfort or health. The increase becomes pathological when it interferes with any of the natural processes. Obesity may be hereditary or acquired. The condition certainly runs in families. It is also more marked in certain races and places. It may be acquired by excess in nutrition and defects in exercise. Of foods, starch, sugar, and alcohol especially contribute to the formation of fat. A sedentary life, indolent habits, prolonged sleep, have the same result by diminishing consumption. The accumulation of fat is physiological after the meridian of life, especially at the period of the grand climacteric in women. "Fair, fat, and forty" is a proverb. Most of the monstrous cases have been females. Benzenberg's four-year-old girl weighed one hundred and thirty-seven pounds, Kisch's ten-year-old girl one hundred and sixty-two pounds, and Regnelle's eleven-year-old girl weighed four hundred and fifty pounds. The bulging face, big body, and waddling gait of these unfortunates always excite amusement, sometimes ridicule.

Obesity shows itself in two *forms*, the plethoric and anæmic (Kisch). The *plethoric* form is more common in men. It is distinguished by fulness of vessels with stagnant circulation, redness of the face, distended pulse, hyperæmia of the liver and lungs, hæmorrhoids, increase of the hæmoglobin and of the number of red blood corpuscles. The *anæmic* form occurs especially in women and shows itself in opposite conditions—in pallor of the surface and of the visible mucosæ, in weakness, languor, neurasthenia, palpitation, dyspnœa, œdema. The pulse is quick and feeble. The blood shows diminution of hæmoglobin and reduction in the number of blood corpuscles. Transition forms occurs in both sexes.

The accumulation of fat shows itself first by an increase at the sites of normal deposit, as in the subcutaneous tissue (panniculus

adiposus). The natural contours of the body are increased. There is visible fulness in the cheeks ; under the jaw, which may present the aspect of a double chin ; in the breasts, on the abdomen, at the buttocks, etc. The breasts may assume monstrous dimensions, and the abdomen become pendulous upon the thighs. Fat accumulates also in regions where it is normally absent, as between the muscle fibres, under the endocardium, in the glands, etc.

Of the internal organs the heart suffers most, and in two ways : by simple accumulation of fat under the pericardium and between the muscle fibres, and by degeneration of the fibres themselves. The subserous accumulation may be so great as to form a distinct envelope—lipoma cordis capsulare (Virchow). Under this condition the action of the heart becomes enfeebled. The impulse may be barely perceptible to the touch or ear. The pulse is correspondingly weak, and is often retarded (bradycardia). In fatty degeneration the changes are more grave. Fatty degeneration occurs much more frequently independent of obesity, and rather in connection with the opposite state, with emaciation, and is the consequence of the action of toxines from infectious processes, malaria, typhoid fever, pyæmia, Bright's disease, cachexia, cancer, or of exhaustion by hæmorrhage, diarrhœa, and is the evidence of chronic myocarditis. Fatty degeneration occurs more especially in acute polysarcia and results from nutritive change.

The lungs are likewise impeded in their action. The excursions of the chest are limited. Hyperæmia supervenes. Attacks of bronchitis are common. Asthma is wont to occur, more especially in connection with enfeebled action of the heart, and severe, even fatal, dyspnœa may result from stasis or œdema of the lungs.

The increase in size of the liver is detected by percussion and palpation. This increase is not attended with tenderness—a point of value in differential diagnosis from organic disease. Gall stones are of not infrequent occurrence in these cases, and they sometimes, though rarely, develop icterus. The stasis in the liver leads to hyperæmia in the radicles of the portal vein, and thus develops catarrh of the stomach with dyspepsia and constipation. The kidneys are embedded in a mass of fat and often show signs of stasis in oliguria, albuminuria, and œdema of the extremities. Glycosuria is also frequent, and diabetes mellitus develops in more than half the cases. These altered metabolic and nutritive changes which lead to obesity predispose also to the development of arterio-sclerosis, with disturbances in the circulation and liability to hæmorrhage. The obese are generally sluggish and dull ; they suffer with a feeling of fulness in the head, with vertigo, tinnitus aurium, muscæ volitantes, and sensations of formication.

The sexual functions are likewise interfered with. Amenorrhœa is common. There is leucorrhœa from catarrh; chronic metritis is not infrequent. Displacements are common, and sterility is rather the rule. The genital organs are atrophied.

The *treatment*, which is wholly a matter of exercise and diet, demands often great self-denial and always much patience. Exercise is best taken on horseback. Children may substitute it with a bicycle; adults with pedestrian excursions, especially with mountain climbing. Oertel justly lays much stress on withdrawal or limitation of water. On the other hand, Tarnier, Karell got good results on an exclusive milk diet, and the quickest results are obtained at Marienbad, Austria, with regulation of exercise, hot baths, and massage, and free libation of the alkaline mineral waters.

The importance of regulation of food was shown in the Banting method—a dietary on which Mr. Banting reduced himself in one year from two hundred and two to one hundred and fifty-six pounds. Improvements in this method were suggested by Ebstein and Oertel, whose formulæ, according to Burney Yeo in Hare's "System of Practical Therapeutics," are published below.

Ebstein recommends the use of fat because it satisfies with less food—a fact which seems to have been recognized even by Hippocrates.

The Ebstein dietary is as follows: *Breakfast* (6 A.M. in summer, 7:30 A.M. in winter): White bread well toasted (rather less than two ounces) and well covered with butter; tea, without milk or sugar, eight or nine ounces. *Dinner* (2 P.M.): Soup made with beef marrow; fat meat with fat sauce, four to five ounces; a moderate quantity of certain vegetables, asparagus, spinach, cabbage, peas, beans; two or three glasses of light white wine; after the meal, a large cup of tea without milk or sugar. *Supper* (7:30 P.M.): An egg; a little roast meat with fat; about an ounce of bread, well covered with butter; a large cup of tea without milk or sugar.

Oertel's formula differs in allowing more albumen and starch and less fat, with a view especially of strengthening the muscle of the heart. This dietary is as follows: *Morning:* One cup of coffee or tea with a little milk, altogether about six ounces; bread, about three ounces. *Noon:* Three to four ounces of soup; seven to eight ounces of roast or boiled beef, veal, game, or not too fat poultry; salad or a light vegetable; a little fish (cooked without fat, if desired); one ounce of bread or farinaceous pudding (never more than three ounces); three to six ounces of fruit, fresh preferred, for dessert. It is desirable at this meal to avoid taking fluids, but in hot weather, or in the absence of fruit, six to eight ounces of light wine may be taken. *Afternoon:* The same amount of coffee or tea as in

the morning, with, at most, six ounces of water; an ounce of bread as an exceptional indulgence. *Evening:* One or two soft-boiled eggs, an ounce of bread, perhaps a small slice of cheese; salad and fruit; six to eight ounces of wine with four or five ounces of water.

Weir Mitchell advises massage, with skimmed-milk diet, to effect a safe and quick reduction in weight. The milk is to be given in just such quantity as to permit a loss of half a pound a day.

DISEASES OF THE
GENITO-URINARY SYSTEM.

CHAPTER IX.

DISEASES OF THE KIDNEY.

DEFINITE knowledge of the diseases of the kidney during life dates from the discovery by Richard Bright (1827) that certain forms of dropsy are distinguished as due to kidney disease by the presence of albumin in the urine. Dropsy, which had hitherto been considered a disease, was now degraded to a mere symptom of disease, and the ability to distinguish one cause of the dropsy was thus established. Bright followed his cases to the post-mortem room. He observed that certain diseased conditions of the kidney were found in cases characterized by albuminuria during life. It seems strange that so much knowledge should flow from a test so simple. It had been occasionally remarked before, especially by Cotugno, that the urine of dropsical patients sometimes contained albumin, but no one before Bright had ever appreciated the full value or the clinical significance of this observation. Bright's paper was entitled "Cases Illustrative of some of the Appearances on the Examination of Diseases terminating in Dropsical Effusion," and the cases themselves are described under the title "Diseased Kidney in Dropsy."

Bright believed that the disease originated in the stomach or skin, and attributed it mainly to cold and bad living, including abuse of alcohol. Two years later Christison, of Edinburgh, published a paper entitled "Observations on the Variety of Dropsy which depends on Diseased Kidney," and two years later again Gregory issued a treatise on "Diseased States of the Kidneys connected during Life with Albuminous Urine." In 1834 Osborn, of Dublin, wrote a work on "The Nature and Treatment of Dropsies accompanied by Coagulative Urine and Suppressed Perspiration." So that the relation between dropsy, albuminuria, and disease of the

kidney received ready recognition. Rayer, of Paris (1840), published an exhaustive treatise on diseases of the kidneys, which he treated under the title "Albuminous Nephritis." Frerichs (1851) distinguished three stages: hyperæmia, fatty degeneration with exudation, and hyperplasia with atrophy. By this time already all forms of kidney disease were grouped under the general title Bright's disease. Rokitansky (1842) was the first to describe a special form of kidney disease, known as amyloid degeneration, which does not really belong to the category of Bright's disease. The study of the relation between the heart and the kidney, first developed by Bright, but especially elaborated by Traube (1865), constituted a luminous epoch in the history of the disease.

These affections of the kidney distinguish themselves by their distribution. The process in Bright's disease is diffuse, not localized or circumscribed, and various forms admit of more or less distinct recognition. These forms may be found associated, or one form may pass into another. There are combined forms and transition stages, but as a rule there may be distinguished in life a form which predominates and gives character to the disease in symptomatology, prognosis, and termination. Such forms only as may be recognized in life merit practical consideration.

While the pathology of kidney disease has undergone much change since the time of Bright, and every pathologist multiplies divisions or establishes new forms, there may be set apart as distinguishable in life *three special forms.*

Of these forms two affect the structure proper, the parenchyma of the kidney, understanding by this term the epithelium which lines the tubules and covers the glomeruli. Parenchymatous nephritis is separable, again, into acute and chronic forms, for the most part of easy distinction during life by symptoms which stand apart. In the third form the inflammation affects chiefly the connective tissue, which undergoes hyperplasia with subsequent shrinkage, to produce the condition known here as elsewhere as cirrhosis. A fourth variety, which, as stated, does not belong to Bright's disease, of later recognition, affects first and chiefly the blood vessels, whose tissue it alters and destroys to constitute what is known as the amyloid change.

A disease which unfits the kidney for its function reveals itself (1) in the secretion of the kidney, the urine; (2) in the effect of retention of toxic elements (uræmia); (3) in the disturbance of the circulation (dropsy). In the separation of kidney disease a case should be approached from the standpoint of the information furnished by the urine, the nervous system, and the dropsy. Distinctions may be drawn by differences more or less pronounced in these respects.

ALBUMINURIA.

The urine is especially distinguished by the presence of albumin (albuminuria), which is recognized by the simple test of coagulation under heat to the boiling point and under nitric acid. These two tests correct each other of any fallacy pertaining to one alone. Phosphates precipitated by heat with the escape of carbonic acid, which helps to hold them in solution, are dissolved by the addition of nitric acid, and urates precipitated by nitric acid are dissolved under heat. When the urine is alkaline the nitric acid should be added in amount equal to one-fifth of the volume of urine. These simple tests suffice for all clinical purposes. Mistakes in diagnosis result, not from failure to resort to more delicate, but from neglect of use of these simple, tests.

The quantity of the albumin is roughly estimated by volume, by the size and density of the coagulum. Urine rendered cloudy or opaque by the presence of blood or pus, detritus, etc., must be first filtered. If it still remains cloudy, usually on account of abundance of bacteria, it will be rendered clear by shaking in a test tube with magnesia usta. Albumin from sources outside of the kidney structure, as from the pelvis of the kidneys, ureters, bladder, etc., belongs to the blood, pus, or other exudation which makes the urine opaque. Outside diseases are also recognized by other signs of these affections. Albumin from the kidney always indicates affection of the epithelial cells; it is, therefore, always pathological. There is transitory and intermittent, but there is no physiological, albuminuria. Any interruption to the circulation of blood through the glomeruli, any interference with the nutrition of the epithelial cells, permits the passage of albumin. Kidneys rapidly exsected under these circumstances show a layer of albumin, under the microscope, surrounding the glomeruli. They also show alteration, cloudiness, multiplication of nuclei, etc., in the epithelial cells.

Albumin in quantity up to one-tenth of one per cent is said to be slight. Such a quantity may be transitory and may indicate no organic disease. One-half of one per cent is a medium grade; one to two per cent a high grade of albuminuria. The presence of albumin alone does not necessarily indicate disease of the kidney, as albuminuria occurs in all the infections, in blood anomalies, anæmia, etc., icterus, certain nervous diseases (paralysis, epilepsy), certain poisonings (arsenic, opium, chloroform, etc.). It is the constant presence of albumin in association with some of the other signs (casts, uræmia, dropsy) that establishes the diagnosis.

True albuminuria distinguishes itself also by its quantity, which in false albuminuria is small. True is further separated from false

—*i.e.*, outside albuminuria (from the bladder, urethra, etc.)—mainly by the microscope.

CASTS.

Of even more importance than albuminuria is the presence in the urine of casts, or moulds, of the urinary tubules. These casts are made up of coagulated albumin, and may contain in addition epithelial cells, blood corpuscles, fat globules, detritus, etc. They sometimes undergo subsequent degeneration into waxy matter. Casts which consist wholly of coagulated albumin are known as hyaline casts. They are clear and colorless, and, though they have linear contours, are often overlooked. Hyaline casts are rendered more distinctly visible for the beginner by the addition of a drop of a dilute watery solution of methyl violet. In this way, also, true casts or true cylinders are distinguished from the "cylindroid" bodies, mere mucous casts, very long masses of mucus, extending through several fields, sometimes split like a fork or teased into threads, with lines of granules along the surface, which are made visible or more visible by dilute acetic acid. Casts which contain, or are composed of, blood corpuscles, red or white, epithelium, fat globules, granules, etc., are known as blood, epithelial, fatty, granular, and waxy casts.

Epithelial casts occur as actual linings of the urinary tubules desquamated in continuo, or as epithelial deposits upon a hyaline basis. The epithelium may be intact or degenerated into fatty, granular, or waxy matter. Epithelial casts indicate actual disease of the kidney structure. They are found especially in acute nephritis or in the acute complications of chronic nephritis.

Granular casts are recognized by the dark color of the granules, which are particles of albumin or fat. They are broader and shorter than hyaline casts, and uniformly granulated. They represent degenerations of epithelium, and occur in the course of all kinds of nephritis.

Waxy casts are also broad and short. They are homogeneous, faintly lustrous, yellowish, with straight or often irregular contours. They represent a stage of degeneration later than the granular, and occur in the more chronic forms of nephritis. The presence of a number of waxy casts in the sediment makes the prognosis very grave.

DROPSY.

Dropsy is due to retention of water on account of defective elimination. It shows itself as œdema of the loose connective tissue, and is usually observed first in the morning in the lower eyelids; later, at the ankles, in the legs. Still later it invades the body, including the serous sacs, to produce anasarca. It is sometimes limited to the

mucous membranes, and may take life in the form of œdema of the glottis, lungs, or bronchi. The fluid of dropsy is distinguished by its abundance of salt and minimum amount of albumin.

URÆMIA.

Uræmia results from the accumulation in the blood of urea and the various salts which should be excreted by the urine. It usually corresponds to the reduction in the quantity of urine, but stands in necessary relation only to the solid matters voided. Uræmia may occur when large quantities of urine are voided, as in renal cirrhosis, in which the bulk of the urine is simple water. It is observed not infrequently after the disappearance of dropsy, with the absorption of solid matters accumulated in the dropsical fluid. Uræmia shows itself in its effects upon the nervous system, in *headache, hebetude, somnolence or insomnia, and anxiety.* It is a frequent cause of obstinate *dyspepsia* with corresponding *degradation of health and strength.* Uræmia distinguishes itself especially by irritative signs, *twitchings* of the muscles of the face and extremities, *spasmodic contractions, convulsions* rather than comatose states. Epileptiform convulsions and comatose states in adult life, in the absence of a history of epilepsy or syphilis, should excite the suspicion of uræmia. These attacks distinguish themselves from epilepsy by their frequent repetition in a short time, as in the course of a single day, and long interval, often of several months. Epilepsy may show the same interval, but not the same immediate recurrence. Sudden blindness, *amaurosis* of central origin, results from the action of the poison on the occipital cortex. It usually disappears in the course of twenty-four to forty-eight hours. *Vomiting and diarrhœa,* direct effects of irritation of the nervous system, often discharge urea vicariously and recover the patient from conditions of danger. More rarely the urea is discharged by the skin. The poison sometimes attacks the respiratory centre, when the patient is seized with attacks of *dyspnœa* simulating asthma, to constitute the so-called renal asthma, which is recognized by its connection with the other signs of uræmia or of nephritis.

During attacks of uræmia the pulse is usually retarded, but is always full and hard. This condition of the pulse depends upon *hypertrophy of the left ventricle,* which always occurs in the course of chronic nephritis, and is due to the increased work thrown upon the heart to overcome the obstruction in the kidneys. The hypertrophy of the heart is recognized, besides, first by the increased tension of the pulse ; second, by the increased area of impact ; third, increased cardiac dulness ; and fourth, accentuation of

the aortic valve sound—all in the absence of evidence of valvular disease.

The quantity of urea is reached roughly, but sufficiently accurately for all practical purposes, by estimate of the whole amount of solid matter. The healthy adult voids in twenty-four hours 1,500 cubic centimetres, containing 25 to 40 grammes—*i.e.*, 2–3.5 per cent—urea. Recent investigations show that in health but 84 to 90 per cent, average 87 per cent, of the nitrogenous matter is urea, while in disease 82 to 86 per cent, average 84 per cent, is urea. The rest is made up of other compounds of nitrogen, uric acid, xanthin, kreatinin, chromogen, ammonia. The amount of urea does not always correspond with that of the other solids. Thus in high fever, notwithstanding the increase of nitrogenous matters, there is a relative decrease of urea. Ammonia is increased in fever, and in high degree in diabetes, while the other extractives are diminished in amount. But knowledge of these points is not yet sufficiently precise to be utilized in diagnosis. We do not yet know which of these bodies produce uræmia. The amount of urea itself is very variable. It varies in different layers of urine in the same bladder (Edelfsen), and estimates are still made from the solids. Clinical experience has shown that the multiplication of the two last figures of the specific gravity by 2 furnishes the quantity of solids for 1,000 grammes, whence the whole quantity is easily computed. Thus in health the specific gravity of a sample from the whole quantity, twenty-four hours, 1,500 cubic centimetres, is 1020, and $20 \times 2 = 40$ for 1,000 cubic centimetres, in all 60 grammes solids. Again, the specific gravity from a whole quantity, 1,875 cubic centimetres, is 1012, and $12 \times 2 = 24$ for 1,000 cubic centimetres, for 875 is $\frac{875 \times 24}{1000} = 21$, which added to 24 = in all 45 grammes solids. The estimate is of especial value in the inception of chronic nephritis and for diagnostic purpose in renal cirrhosis.

HYPERÆMIA.

Hyperæmia of the kidney (stasis) occurs in consequence of interference with the general circulation, as in diseases of the lungs and heart. Stasis of short duration interferes with the action of the epithelial cells; permits the escape of albumin, which may form a transparent, colorless exudation in the urinary tubules, to appear in the urine as the so-called hyaline casts. In the long-continued stasis which occurs in the course of chronic heart failures, the kidney becomes hard, the color fades from the cortical substance, to constitute the condition known as cyanotic induration. Infarction is attended with the accumulation of blood in the affected domain and hæmorrhage into the capsule and urinary tubules. Destruction

of the kidney substance ensues, with the formation of extensive cicatrices.

ANÆMIA.

Anæmia of the kidney occurs in the course of general anæmia, reduces the size of the kidney, and diminishes the quantity of urine. In chronic states it is best observed in the course of senile atrophy and arterio-sclerosis, when the urinary tubules in the affected regions are found collapsed, empty, and filled with atrophied epithelial cells. The arteries are bent and tortuous, in places obliterated; the connective tissue hyperplastic; the substance of the kidney is often permeated with cysts.

ACUTE PARENCHYMATOUS NEPHRITIS.

Acute inflammation of the kidney was recognized before the days of Bright. It was not known, however, that the disease was a diffuse process. It was simply assumed that disease of the kidney existed, on account of the change in the condition of the urine. Wells had actually called attention to the fact that the urine after scarlet fever might contain albumin, even in the absence of blood. Bright himself did not appreciate the relation between scarlet fever and disease of the kidney, and probably had no occasion to observe the changes of acute nephritis. It is interesting to note that Hamilton as early as 1833 declared that he had found the scarlet-fever kidney in a case without dropsy. All nephritis is caused by the passage through the kidney of toxic matter. It was assumed that a ready explanation of the frequency of Bright's disease would be found in the passage through the kidneys of micro-organisms on their way out of the body. It was, however, soon observed that micro-organisms do not escape from the kidney unless the kidney be diseased, and are even then to be discovered with difficulty. The abandonment of this view, that micro-organisms produced Bright's disease, seemed to disturb the dependence of these diseases upon infectious processes. With the discovery later of toxines and toxalbumins in the urine the relation of the infections was re-established. It was recognized that kidney disease could be produced by the injection of chemical irritants. A typical example of chemical irritant derived from life is offered in cantharidin, which may produce a typical acute nephritis. So this condition has been seen to occur after an extensive vesication, or more especially after the internal administration of the tincture of cantharides. Acute nephritis may occur in the course of any infectious process. Scarlet fever heads the list. Scarlet fever is the cause of more than half the cases of acute nephritis. The kidney complication occurs more especially in certain epidemics and is absent in others. Thus of one hundred and eighty cases in 1853–54

treated by Bartels, twenty-two were followed by nephritis; and of eighty-four cases in 1863, thirteen showed the same complication, fatal, strange to say, in every case. Bartels declares that in other epidemics he had met scarcely a single instance in a hundred cases.

Nephritis in these cases was formerly attributed to early exposure to cold. It was observed, however, that the accident occurred with equal frequency in cases long confined to the house and to bed. Nephritis was evidently not due to affection of the skin or suppression of its secretions, as it is almost never seen after small-pox or extensive burns—conditions attended with the most marked destructive lesions of the skin. The complication sets in, not in the course of, but as a sequel to, scarlatina proper. Nephritis develops somewhere between the second and fifth weeks, in the average at the end of three weeks, after the disappearance of the eruption. It is, therefore, a post-scarlatinal process. Though it appears at this late period, it begins earlier and assumes proportions to make itself manifest by this time. It is needless to state that nephritis gravely complicates a case of scarlatina.

After scarlet fever, diphtheria, among the infections, takes the second place in the production of this disease. The remaining infections—measles, rötheln, small-pox, pneumonia, etc.—only rarely show this complication; typhoid fever, for instance, not once in a hundred times. The diseases cited account for more than half the cases. Most of the rest are attributed to "taking cold." A certain contingent of cases is caused by pregnancy. These two factors act by liberating chemical poisons whose exact nature is unknown. Acute parenchymatous nephritis is, therefore, always a secondary process.

Symptoms.—After scarlet fever and in the course of pregnancy the disease sets in suddenly, as a rule; after taking cold the onset is more insidious. The attack may begin with a series of chills and light rise of temperature. There is noticed an *increased frequency of micturition.* The urine is *reduced in quantity* to one-half to one-quarter of the normal amount. The secretion is sometimes entirely suppressed. With the diminution in quantity there is corresponding increase in specific gravity to 1025–1030. Where the quantity is not markedly diminished the specific gravity may not be materially lessened. The color may be darker from admixture of blood, and will show variations from a light tinge to almost black, corresponding to the amount of blood. Tested by heat or nitric acid, it shows *albumin* in quantity varying from a fraction of one to two per cent. Tube casts, *epithelial and blood casts*, are usually present. *Dropsy* occurs as a rule. It is usually first seen about *the eyelids, which are puffed;* the face is swollen later. The face has

a bloated, pallid, unwholesome look. Dropsy appears later in the subcutaneous tissue everywhere, and, in the course of the disease, in the serous cavities. It may take life by suffocation, from œdema of the glottis, or more especially from œdema of the lungs.

Nervous symptoms are also prominent. Individual cases are ushered in with *headache, severe neuralgic pain, vertigo, nausea, and vomiting.* Occasionally the first intimation of the existence of the disease is a *convulsion.* The nephritis of pregnancy is wont to announce itself by sudden blindness and convulsions. Sopor, stupor, and coma belong to this state.

The *diagnosis* is easy, as a rule. The preceding infection, when it shall have existed, the time, the occurrence, the peculiar train of symptoms, the state of the urine, the dropsy, and the nervous phenomena, unmistakably stamp the disease.

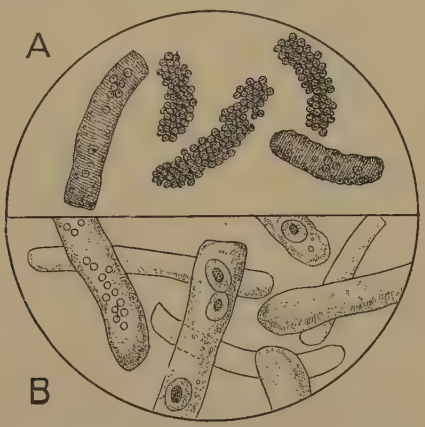


FIG. 265.—Casts of the urinary tubules in nephritis: A, blood casts; B, hyaline casts.

The *prognosis* is always grave, though the future is mainly determined by the early recognition and speedy treatment. A case assumes gravity in correspondence with the diminution of urine. Anuria is an ominous sign. Yet children have recovered after total anuria of three weeks; in these cases the poisonous elements have found escape through other emunctories—intestinal canal, the skin, lungs, etc. The presence of blood is not so grave as might appear. Hæmaturia is common in acute nephritis. Yet the prognosis remains grave in the presence of bloody urine. The amount of albumin may have its weight in determining the future of a case. Dropsy is not so dangerous as nervous symptoms, especially convulsions. Comatose states are always grave. Patients may succumb in any paroxysm of convulsion or in any attack of coma. The immediate effect of treatment has its bearing upon the prognosis.

Treatment.—Any knowledge of the nature of the disease process will carry with it the dangers of diuresis. The routine administration of digitalis or other diuretic is dangerous. The kidneys are already clogged, the blood vessels are ectatic, the tubules blocked with epithelial débris, blood casts, and detritus. The true treatment is to flush out the kidneys with frequent libations of water, preferably warm drinks. Mucilaginous drinks, toast water, have the advantage that they may be taken sweetened without aversion by a child. Adults take more kindly to acidulated drinks, lemonade, and soda waters. Milk is the best food, drink, and drug at any age.

The scientific treatment of the dropsy consists in appeal to the skin whereby the kidneys are unloaded. Derivation of blood to the skin is best effected by the hot bath, which is, in the treatment of all forms of Bright's disease, almost a *sine qua non*. Patients, especially in acute nephritis, should be treated to the hot bath two or three times in the course of every twenty-four hours. The patient should be immersed in the bath, except the head, which should be enveloped in a towel wet with cold water. The temperature of the bath should be kept at 100° F., and there should be a supply of hot water to continue this temperature during the bath, which may last from five to fifteen minutes. The patient is then rolled in blankets, put into bed previously warmed, and allowed to sweat for an hour or more. The process of sweating unloads the kidney. It happens not infrequently that the patient falls asleep after the bath, as the first restful sleep during the attack. A quantity of more normal, clear urine may pass immediately upon awakening. All clinical experience abundantly justifies this resort to the hot bath as the true treatment of acute nephritis. The bath, as stated, must be repeated again and again, and continued in the treatment of a case until all signs of the disease shall have disappeared.

Where a bath is totally impracticable a substitute may be found in the hot pack. A child may be enveloped in blankets which are covered in with a rubber cloth, and the body heated by hot bricks and hot-water bottles in the bed. The process is much more discomforting than the hot bath and is much less efficacious. It has about the same relative virtue as the cold pack to the cold bath in the treatment of fever. The hot pack may be itself impracticable. Hot packs and hot baths alike at times affect the heart. In these cases resort may be had to the use of drugs, the most efficacious of which is pilocarpine, which should be used with caution subcutaneously in doses of gr. $\frac{1}{12}$–$\frac{1}{8}$–$\frac{1}{4}$. Sweating usually occurs rapidly, often within a few seconds, after the hypodermatic use of pilocarpine. It may also be profuse and may be sustained by repetition of the remedy. Pilocarpine is a dangerous drug and should not be indiscriminately

employed. The physician may have to choose this remedy as the lesser evil. Sometimes it acts admirably.

Convulsive attacks must be cut short at once by chloroform or ether, and frequently repeated attacks may be prevented with the use of chloral in doses of ten to fifteen grains, more or less frequently repeated. As a shield to the nervous system resort may be had also to the subcutaneous use of morphia. With chloral and morphia the brain may be protected until the poison of the disease is eliminated. As a rule the poison seems to inundate the nervous tissue in waves, so that vigilance and active treatment are demanded for several days or for a week or more. A light diet—milk—a warm temperature, confinement to bed, later to the house, restraint of exercise and excitement, fulfil the remaining indications.

CHRONIC PARENCHYMATOUS NEPHRITIS.

This form constitutes the bulk of the cases of Bright's disease. It occurs less frequently alone; it is often combined with other forms, especially with renal cirrhosis and amyloid degeneration. Yet during the greater part of its course it is independent, and becomes in its further progress associated with other forms. The view that Bright's disease presented itself as a single affection with three stages —acute and chronic nephritis and renal cirrhosis—proved so simple as to be seductive. It is, however, unfounded in fact. Chronic very rarely develops from the acute parenchymatous form. The acute nephritis which occurs in consequence of the infections, except scarlet fever, terminates life or terminates itself in resolution. It almost never becomes chronic. Occasionally the form that occurs in connection with scarlatina and pregnancy assumes a more chronic course. Rather more frequently the acute nephritis which is, for want of a better explanation, ascribed to cold becomes chronic. Those cases which result from suppurative processes, inveterate syphilis, and tuberculosis are more wont to become chronic because of persistence of the cause. All these causes combined constitute only the small minority of cases of chronic parenchymatous nephritis.

The disease arises for the most part without discoverable cause, and develops itself so insidiously as to be recognized, as a rule, only after a duration of several months. Chronic nephritis develops in consequence of the existence of a concealed cause. The disease is for the most part as yet cryptogenetic. It is assumed that some chemical poison, a toxine in the process of slow elimination from the body through the kidneys, causes the disease. In connection with suppurative processes Fischer found the acid butyrate of soda, the escape of which through the kidneys might have caused the disease.

The question has interest, aside from the explanation of chronic kidney disease, as a demonstration of the existence of latent poisons.

Symptoms.—Chronic parenchymatous nephritis distinguishes itself, as a rule, by its insidious onset. The patient complains of no signs which distinctly refer to the kidney. Sometimes there is pain, more often dull, dragging sensations in the region of the kidneys, to be attributed sometimes to distention of the capsule (hyperæmia), but rather to lumbago than disease of the kidney. The disease shows itself usually first in *depression of spirits and degradation of energy.* Life loses its zest; avocation, before a pleasure, becomes a drag. Effort brings on *early fatigue.* There is loss of appetite,

Fig. 266.—Retinitis albuminurica with irregularly scattered white patches (Magnus).

listlessness, drowsiness or the opposite state, *insomnia.* Sleep fails to refresh. The color changes, the hue of health is lost to be substituted by *pallor*, which becomes an ashy-gray. There is *loss of weight*, which progresses gradually and indicates with the general failure of health what the people call a decline. But there is or need be no cough and no other sign of disease of the lungs. Patients consult the physician for repair of broken health and relief of broken spirits. Sometimes there may be noticed early *puffiness about the face*, bloating of the eyelids, swelling of the ankles. After the work of the day the shoes are tight. The swelling subsides in the night.

The disease sets in less frequently with nervous signs. There is, with the *hebetude, headache, neuralgic pains*—trigeminal, sciatic,

much more frequently occipital and intercostal. There may be palpitation and shortness of breath to simulate the onset of tuberculosis or heart disease. The diagnosis is sometimes first established by the oculist, who discovers in a retinitis albuminurica an explanation of the disease.

The urine is diminished in amount to two pints, to a pint, to a half-pint or less, in twenty-four hours. There is seldom that extreme oliguria, and never the absolute anuria, which is sometimes seen in acute nephritis. The occurrence of anuria would indicate a complication, more especially the supervention of acute nephritis. In accord with the reduction in quantity is an *increase in specific gravity* to 1025–1030–1040, weights which excite the suspicion of diabetes, which is readily excluded by observation of the diminu-

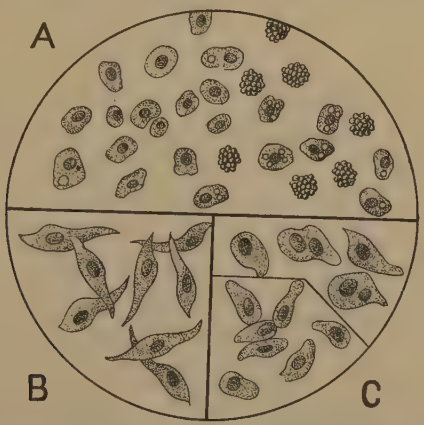


FIG. 267.—Epithelium in urine of nephritis: A, desquamated cells, many in fatty degeneration; B, epithelium from pelvis of kidney; C, epithelium from female (above) and male (below) urethra (Wesener).

tion in quantity. The urine is also correspondingly turbid. On standing a heavy *sediment* falls to the bottom of the vessel. *Albumin is always present.* Albumin distinguishes itself not only by its presence, but by its amount. It may exist in the urine in an amount which is not equalled in any other form of kidney disease. All the fluid seems to set solid on boiling or on addition of nitric acid. The albumin may amount to as much as five per cent. It usually ranges about one or two per cent. The sediment consists of epithelial detritus, fat bodies, white blood corpuscles, and tube casts. White corpuscles are present in large amount. Nearly all forms of *tube casts* may be observed in different cases—hyaline casts; epithelial casts which show fatty change; desquamated epithelial cells, also in a state of fatty degeneration; granular casts, more strictly indicative of chronic nephritis; and *broad, waxy casts*, which are

found exclusively in chronic nephritis and in advanced forms of the disease. They distinguish themselves by their size as well as by their color. They represent advanced changes in the epithelium of the larger and of the largest tubules. They contribute more than any other element in the urine to make the diagnosis and to establish the prognosis.

The *dropsy* distinguishes itself also by its amount. It is or becomes universal. It varies of course in degree, but may be discovered somewhere in the body in nearly every case. In one hundred

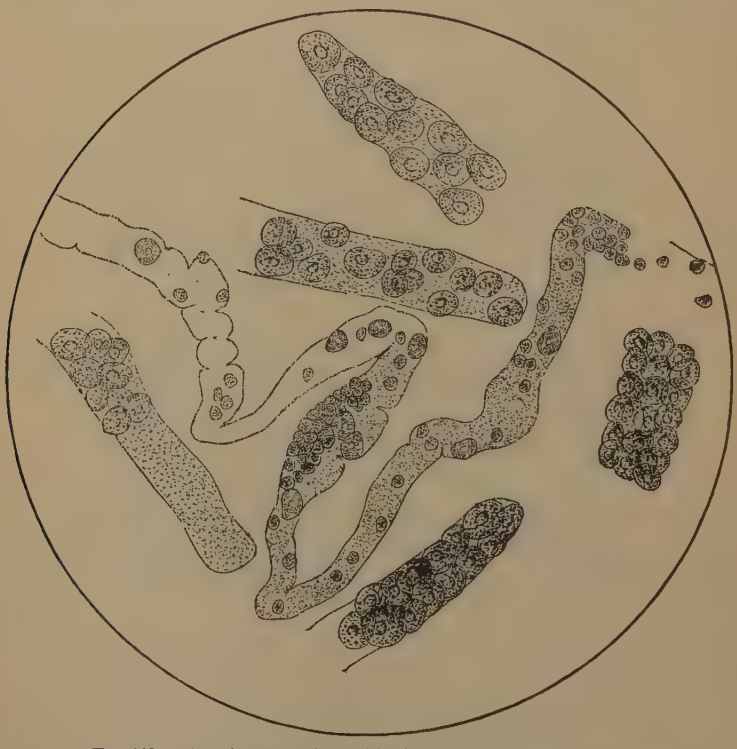


FIG. 268.—Chronic nephritis: epithelial and mixed casts (Peyer).

consecutive cases Johnson found it absent only twice. It is noticed first, as a rule, about the face, but soon shows itself in the lower extremities and accumulates in the subcutaneous connective tissue to constitute anasarca. It mounts up the legs, the skin of which it may distend to the utmost degree. The surface then becomes tense and shiny as if glazed. Finally rupture may occur with the escape of fluid in continuous quantity, and sometimes with subsequent extensive sloughing and gangrene. The serous cavities are subsequently invaded. Fluid accumulates in the peritoneum, in the

pleura, and most dangerously in the pericardium. Œdema of the glottis is not quite so frequent as in the acute form of the disease; but œdema of the lungs, especially in connection with subsequent heart failure, often terminates the disease with the life of the patient. Œdematous states of the mucous membrane of the intestinal canal are not infrequent. Obstinate vomiting and diarrhœa, sometimes with sloughing and the formation of ulcers, distinguish certain cases. Inflammations of the various serous membranes, pleuritis, peritonitis, pericarditis, inflammation of the lungs, pneumonia, as excited by the presence of toxic matters, constitute terminal links in the chain of disease process.

The *nervous symptoms* in this form of kidney disease are comparatively insignificant. They may assume prominence in an individual case. The disease, as stated, may be announced by headache, vertigo, the neuralgias, etc., or convulsions and comatose states may occur in the progress of the disease; but these uræmic symptoms are infrequent. They are noticed also to *occur less frequently in cases of most extensive dropsy.* It is assumed that the dropsy is a kind of reservoir for the accumulation of toxic matters, which are thus held in solution away from the blood and nervous system. All kinds of nervous symptoms may occur in exceptional cases, marked even by dropsy, and ugly pictures are sometimes shown of convulsions in a body distended and distorted by dropsy. Any predominance of nervous symptoms would indicate a case complicated with acute nephritis or renal cirrhosis.

The *diagnosis* rests upon the general failure of health and strength, upon the bad color, loss of appetite, progressive emaciation. The emaciation may be masked by dropsy, but is manifest in extreme degree with the subsidence of the dropsy. The diminution of the quantity of urine, the high specific gravity, the turbidity, existence of albumin in quantity, presence of a heavy sediment of white blood corpuscles, tube casts, and detritus, the dropsy which distinguishes itself by its range and amount, the few, scattered, and for the most part insignificant nervous symptoms, distinguish this form of Bright's disease.

The *prognosis* is always grave, mainly for the reason that the disease is not recognized until damage is done. But chronic parenchymatous nephritis is by no means of necessity fatal. Other things being equal, it may be said that the future is determined by the duration of the disease. A case which has lasted not over a year may recover. *The character of the tube casts, more than any other single element in the urine, determines the prognosis.* The presence of broad, waxy casts especially indicates an advanced stage of the disease. Dropsy is not dangerous. The largest accumula-

tions may be speedily removed and reaccumulations may be held below the line of danger. Nervous symptoms are always grave in correspondence with their own gravity. Convulsions and coma are ominous signs.

The *treatment* does not differ materially from that of the acute form of the disease. The true principle of therapy is the flushing of the kidney of its epithelial débris and exudation, and elimination of the toxic elements through the skin. The patient should drink freely of water, pure water, alkaline mineral waters. Milk is both food and drink, and cases have been cured by milk diet alone. Unfortunately in chronic nephritis life may not be sustained indefinitely on this diet. Buttermilk is an aid and substitute, as is also kumyss. The most scrupulous attention must be paid to the skin, which should be protected from every exposure. Patients with this form of Bright's disease should remain in doors in all bad weather. Blustering, raw winds should be shunned. Wet weather is dangerous. In any kind of acute exacerbation or advanced form of the disease the patient should stay in bed, where alone may be secured an equable, warm temperature. Underclothing must be warm and clean. The same dress may not be worn day and night. The diet should be simple, plain, and nutritious. It should consist mainly of vegetable food. Baths must be given as directed in the treatment of acute nephritis. They are especially indicated in the presence of nervous signs. There is not the same objection to the use of cardiac diuretics in chronic as in acute nephritis. To strengthen the force pump while the sluice gates are opened is to attack the disease in flank as well as in front. The most effective diuretic is digitalis, which may be given at first, in the form of the effusion, in teaspoonful, dessertspoonful, or tablespoonful dose. The infusion should be made fresh from the leaves, and the use of it should be discontinued so soon as the pulse under its full action becomes firm and hard. Too prolonged administration may tetanize the heart. After several days the remedy may be resumed in the same or less dose, or in another form, as the tincture five to fifteen drops. As the infusion does not keep long, a small quantity, six to eight ounces, should be prescribed at a time. The preparation is made much more efficacious in the treatment of kidney disease by the addition of ten to fifteen grains of the acetate of potash to each dose. Digitalis may be for various reasons contra-indicated. It may be substituted by strophanthus, gtt. v.–xv., diluted, three times a day. For quicker action resort may be had to the natro-benzoate of caffeine in two- or three-grain powders every two or three hours. The powder, dry upon the tongue, is usually washed down with soda water. Still better is diuretin in solution:

℞ Diuretin ..... ʒ i.–ʒ ij.
Aquæ menthæ piperitæ ..... ʒ iv.
M. S. Tablespoonful every two to four hours.

For immediate results in cases complicated with cirrhosis no remedy equals nitroglycerin, which not only tones the heart, but has the additional advantage that it relaxes any spastic contraction of the arterioles, especially in the kidney, to permit an easier release of accumulated matter. Where the distention of the skin threatens to produce rupture with its associated dangers, this accident may be prevented by the introduction of fine silver canulæ, Southey's tubes, or by puncture in several places, as on the dorsum of the foot or the most distended part of the leg. Great caution must be exercised with these punctures that the skin be washed clean with soap and water and rendered aseptic with the solution of sublimate 1 : 1000. The physician may not use the knife which the surgeon employs for other purposes. The most minute puncture suffices to permit the escape of a drop, which oozes down in a fine stream to discharge in the course of time surprising quantities of fluid. Dyspnœa, so great as to cause orthopnœa, may be relieved in this way in a single night. There must be dyspnœa or other great discomfort, or threatened rupture of the skin, to justify the procedure. Sometimes a dose or two of elaterin, or of calomel after the mode specified in heart disease, may postpone the necessity of puncture. In subsequent treatment resort is usually had to the iodides, which are best given with milk. The tincture of iron gtt. xv.–xxx. in sweetened water, bitter tonics, tinctura rhei aromatica ʒ ss.–ʒ i., strychnia, as in the tincture of nux vomica gtt. x.–xx., may be demanded in an individual case. A change of residence to a warm, dry climate is worth all the drugs in the materia medica.

RENAL CIRRHOSIS.

Interstitial nephritis rarely occurs in the course of, or as a sequence to, other forms of kidney disease. The transition of acute into chronic parenchymatous nephritis is more frequent than the occurrence of the cirrhotic kidney in consequence of parenchymatous inflammation. The processes may be combined, but they may not be said to originate the one from the other. There is certainly a relation between renal cirrhosis and gout. English and French writers describe the gouty kidney. This relation is rarely observed in our country, because of the infrequency of gout.

Morbid Anatomy.—Though the obvious anatomical lesion is a hyperplasia of the connective tissue to such degree as to strangulate vessels, tubules, and epithelial cells, the disease does not begin in the connective but in all cases in the parenchymatous structure. Renal

cirrhosis shows on section the small granular kidney with adherent capsule, atrophied cortex, retention cysts, and apoplexies in the substance of the kidney.

Etiology.—Renal cirrhosis arises for the most part from unknown cause. Luxurious habits, alcohol, heavy meals, more especially of meat, have been accused of causing this form of nephritis, but without proof. Renal cirrhosis occurs in all classes—among domestics, artisans, merchants, professional men. It occurs without regard to avocation. It is unknown in infancy and is rare in age. The majority of cases are discovered between adolescence and maturity. The great number of apparent cases in age are considered as scleroses of advanced life. The disease is four times as frequent in men as in women.

Symptoms.—Renal cirrhosis is the most insidious of all forms of kidney disease. It may reveal its presence suddenly, as by a stroke of apoplexy, but even in these cases, as a rule, only after a long, more or less latent existence. During this latent stage there is the same general *degradation of health and spirits* noticed in the other forms of chronic nephritis. The color changes, the hue of health is substituted by pallor. Fatigue follows slight effort. *Nervous signs predominate.* Headache is frequent and obstinate. The condition may be first disclosed by an attack of asthma. *Palpitation* of the heart is a frequent precursor and attendant of the disease. Certain cases consult the oculist for *blindness* or disturbance of vision. The first symptom to excite suspicion at times is *hæmorrhage*, frequent and severe—nose-bleed, or hæmorrhage from the stomach or bowels. Not infrequently the physician is led up to the diagnosis by an examination of the *urine*, made in the absence of any other signs adequate to explain the condition. *The urine is abundant.* It is usually clear, limpid, with a greenish tinge. Patients must pass water several times during the night; they are hence easily misled to believe that the kidneys are perfectly free from disease. The quantity may be doubled or trebled. Urine is discharged more frequently at night because it is secreted more abundantly at night. At times there is associate thirst, which, with the greater discharge of urine, may bring the patient to the physician with a suspicion of diabetes. *The specific gravity is light*, 1010 and under. *The urine is clear*, deposits on standing but little sediment, and shows but few isolated hyaline casts. So scant is the deposit of sediment that the urine should stand in a conical glass over night to collect it, or, better, be precipitated in the centrifuge apparatus, which causes immediate or quick deposit by rapid rotation. Permanent preparations are kept by being bedded in glycerin-gelatin: gelatin one part, water six parts, glycerin nine parts, with a few

drops of carbolic acid. *Albumin may be entirely absent* in the specimen examined, hence the necessity of collecting the urine of the twenty-four hours; a sample from the whole quantity will nearly always reveal albumin, but usually in very slight amount. It forms on boiling, or on the addition of acid, a slight cloud, which reveals itself best by contrast with the fluid in an unheated test tube. It is a good plan to boil simply the upper strata. When the tube is held against a dark background, the mantelpiece or coat sleeve, a very slight opacity is perceptible. The urea is correspondingly diminished.

Dropsy is usually absent. It may show itself at some time or other during the course of the disease, and always accumulates at the close when the heart begins to flag in its force, but it is absent, as a rule, during the progress of the disease. Yet the disease is sometimes announced by puffiness of the eyelids and œdema of the ankles, and in the last stages, for the reason stated, there may be anasarca or œdema of the lungs. As a substitute for the absence of dropsy, and as a cause for its absence, there is *enlargement of the heart.* The left ventricle undergoes hypertrophy. Bright noticed this change, and attributed it to extra work thrown upon the heart by the occlusion in the kidneys, and to chemical change in the blood which irritates the heart. Thus symptoms on the part of the urine and symptoms connected with dropsy are few and far between in renal cirrhosis. On the other hand, the *nervous symptoms* distinguish themselves by their prominence. Individual cases are announced, as stated, by attacks of apoplexy, which may result from simple uræmia or from actual break of a vessel in the brain. Apoplexy or coma in adolescence or maturity, without other obvious cause, should excite the suspicion of Bright's disease. The same thing may be said of epilepsy. Where this disease has not existed in the previous history attention should be at once directed to the kidney. Headache, neuralgia, vertigo, disturbances of vision, occur throughout the course of the disease. Asthmatic attacks are not infrequent. They occur in the night with the same dyspnœa and distress as in true asthma. Patients succumb to some expression of uræmia more frequently in this than in other forms of chronic nephritis. Explanation of the frequency of uræmia with free, copious urine is found in the fact that the urine, though free, contains but little solid matter. Uræmia results from the retention of toxic matter whose exact nature is unknown. Exemption from uræmia is due to the fact that the urea is eliminated through other avenues—the lungs, skin, the intestinal canal. Crystals of urea are sometimes, though very rarely, seen upon the face, to present the appearance of hoarfrost or a surface freshly lathered for shaving. The odor about the body is sometimes marked.

The *diagnosis* of renal cirrhosis is not difficult. The voidance of excessive quantities of clear urine of light specific gravity, nearly free of albumin, detritus, and tube casts, stands in marked contrast to the reduced quantity of turbid, highly albuminous urine of parenchymatous nephritis. The absence of dropsy is a striking feature Dropsy is absent, as stated, so long as the hypertrophied heart may force fluids through the kidney. The great frequency and severity of nervous symptoms speak also for renal cirrhosis. Hypertrophy of the heart may occur also in parenchymatous nephritis. It occurs always in renal cirrhosis. It is recognized by displacement of the apex to the left, increase in dulness to the left, accentuation of the aortic valve sound, heard best at the second interspace on the right, increase in the tension of the radial pulse.

The differentiation of renal cirrhosis from renal arterio-sclerosis, always difficult, is sometimes impossible. Arterio-sclerosis is more distinctly a disease of age or of alcoholism. Patients are usually males who have suffered no previous disease of the kidney, who begin to show light uræmic signs, with slight dropsies (œdemas) which come and go. Attacks of palpitation point to hypertrophy of the heart, which is readily recognized. The urine shows albumin in traces or transitorily, sometimes also hyaline casts, but, instead of being increased, is, as a rule, decreased in quantity. The diagnosis really rests more upon the evidence of age or of arterio-sclerosis elsewhere, especially in the brain.

The *prognosis* is always grave. The natural tendency of the disease is to continued destruction of the kidney substance. The consequences of this evil are averted for a time by hypertrophy of the heart, so that the affection of the heart, as revealed especially by the state of the pulse, is a gauge of the gravity of the disease. Uræmic symptoms are always grave. Convulsions and coma are ominous signs. Attacks of asthma occur late in the history of the disease.

The *treatment* differs in no respect from that of parenchymatous nephritis. There must be made the same appeal to the skin in substitution of the kidneys as before, and treatment must be continually directed to sustain the heart and reduce the tension in the distant vessels. The hot bath is practised with the same precaution as before. The temperature should be kept at 100° to 110°, and the patient should remain in the bath from five to fifteen minutes or more. Sweating is to be encouraged by blankets and hot teas. When the heart begins to flag it must be stimulated with digitalis, strophanthus, or caffeine. To relieve the resistance offered by tension of the arterioles no remedy is so good as nitroglycerin, which may be administered in doses of one to three drops every four to six hours. Administration of the remedy may be continued in varying doses for

several weeks. The diet should be simple, chiefly vegetable, largely fluid. Milk is the best animal food. It may be agreeably substituted, especially in summer, by buttermilk, or at any time by kumyss. The skin must be protected by warm underclothing at all times, and by stay in the house in bad weather. During any exacerbation the patient should remain in bed. Other evils are counteracted after methods already discussed.

AMYLOID DEGENERATION.

The amyloid kidney is not one of the forms of Bright's disease. The process is diffuse and is part of a widespread degeneration. The condition is recognized, as a rule, only when it attacks the kidney, and may hence be best studied in this connection, especially in that it so frequently complicates or results from other forms of kidney disease, notoriously from chronic parenchymatous nephritis, which is itself a suppurative process.

History.—Amyloid degeneration was first seen on the post-mortem table, as might have been anticipated, in the liver.

Budd says of Laennec, who noticed everything, that he noticed also the "waxy" liver, which he, however, considered to be a variety of fatty liver. The first mention of the condition with a distinct description was made by Antoine Portal in 1813, who says that he "found the liver excessively voluminous, reduced to a substance like lard, both in color and consistence, in the body of an old woman who had various exostoses and ulcerations about the genital organs." Nothing but unimportant and isolated observations, as by Budd, Andral, Graves, were then made in the history of amyloid degeneration until 1842, when Rokitansky cleared up the field by showing that amyloid degeneration was a general process with local expressions in different organs, and that it stood in close genetic relations to certain cachexiæ. Rokitansky was the first to describe amyloid degeneration of the kidney. Gairdner and Sanders next (1854) demonstrated that the waxy condition of the liver and kidney also showed itself in the spleen, while Virchow and Meckel almost at the same time (1853) had already discovered the iodine and sulphuric-acid reaction which enables the pathologist to distinguish amyloid matter in any organ at any time. It was this reaction which gave it its name. Starch is colored blue by free iodine. The coloration of amyloid matter is not blue, but violet, deepening to mahogany. Virchow called it matter like starch—*i.e.*, amyloid. Friedreich and Kekulé (1860) demonstrated that it is neither starch nor fat, but a pure albuminous principle.

After the nature of amyloid matter had been decided, the next point of interest was to determine whether it was a material circu-

lating in the blood and deposited in the tissues where it was found, or whether it was a result of disintegration or retrograde metamorphosis of the tissue itself; in other words, whether it was a mere infiltration or a true degeneration.

What seemed to lend special support to the infiltration theory was the place of its first deposit. Virchow and Recklinghausen more especially emphasized the point that amyloid matter is first found in the walls of the blood vessels. Moreover, it was noticed that the most vascular organs—the spleen, the liver, and the kidneys, organs which stand in the most intimate relations with the blood—are the most frequently and extensively affected. But, it was maintained on the other hand, amyloid matter has never been found in the blood. Moreover, amyloid matter is not infrequently found in strictly circumscribed or isolated deposits, as a purely local change, and not as a local expression of a constitutional condition. Thus Billroth observed two cases in which individual lymph glands had taken on amyloid change; Hirschfeld reported an amyloid degeneration in a single mesenteric gland after a case of typhoid fever; Kyber described cases of amyloid degeneration in inflammatory neoplasms; Oettinger, Sämisch, and Leber, amyloid degeneration of the sclerotic, producing hypertrophic exuberations similar to those of trachoma; Burow, a case of amyloid degeneration of a fibroid tumor of the larynx. Friedreich states that he got the amyloid reaction from the interior of old blood clots; Juergens had the same results in thrombi of the endocardium; Virchow from the intervertebral, tracheal, and symphyseal cartilages of old people; lastly, Ziegler describes amyloid tumors of the tongue and larynx that had developed in the immediate vicinity of old gummata which had run their course.

Amyloid matter has four distinguishing characteristics—viz., *a peculiar consistence* (like dough or caoutchouc), *a waxy lustre, a vitreous translucency, and a lack of color.* But neither the macroscopic nor microscopic appearances enable us to pronounce upon it unmistakably. The true test of amyloid matter is its *reaction* with iodine and sulphuric acid. The surface to be tested must be first washed free of blood, else a mistake is very easy, and then painted over with a brush dipped in an aqueous solution of free iodine. In a few minutes the amyloid matter is colored violet or brownish-red like the color of mahogany. On the superaddition of sulphuric acid the mahogany color changes to blue. The iodide and chloride of zinc show the same reactions, as do also the iodide and chloride of lime; and methylanilin distinguishes itself in this reaction by coloring the amyloid parts a beautiful red, while the unaffected parts assume a bluish or violet tint.

Regarding age, sex, and social state, amyloid degeneration occurs at all ages, and even congenitally as the result of hereditary syphilis. Frerichs found among his sixty-eight cases three under the age of ten years and nineteen between the ages of ten and twenty ; and from Wagner's forty-eight cases it is seen to occur in five cases under ten and in five between ten and twenty. The male sex is two or three times more frequently affected—a singular fact, as Frerichs justly remarks, because the diseases which induce this degeneration by no means especially affect the male sex. Tuberculosis and syphilis have no regard for social caste, hence this affection is no respecter of persons.

Amyloid degeneration *follows*, in the rule, *some disease attended with protracted suppuration.* Dickinson proposed an ingenious theory to account for it, based upon this fact, to wit : Pus is alkaline, and the long drain of pus dealkalizes the blood ; dealkalized fibrin is amyloid matter ; the scientific treatment of the condition, therefore, is the administration of the alkalies. Unfortunately for this beautiful theory, typical cases of amyloid degeneration may be unattended or unpreceded by suppuration.

Tuberculosis is the most prolific cause of amyloid degeneration. Wagner gives the percentage of cases at 56.25, Weber at 40.55, Hoffman at 67.5. Bone caries is followed by amyloid degeneration, according to Wagner, in 23 per cent of cases ; Weber, 38 per cent; Hoffman, but 7.5 per cent of cases.

Symptoms.—The *urine is increased* in quantity, as a rule, though never to the degree characteristic of renal cirrhosis. It is usually *clear* and shows *light specific gravity, contains albumin* in varying amount, sometimes scant, sometimes abundant, *a few clear casts and white corpuscles. Dropsy is rare.* What there is *shows itself in the lower extremities* rather than in the face, and is due not so much to the kidney disease as to the general hydræmia of the cachexia. Many cases of amyloid kidney show no dropsy from beginning to end. Grainger Stewart saw general dropsy only six times in one hundred cases. With the œdema of the legs there is often *ascites*, due to obstruction in the portal vein from simultaneous affection of the liver. The process implicates also the mucous membrane of the alimentary canal. *Vomiting and diarrhœa* may be profuse and defiant of control. With much affection of the liver the stools are excessively offensive from lack of bile, and with much affection of the bowel they may show under the microscope, along with leucin, tyrosin, and fat, actual masses of amyloid matter, recognizable by the chemical test.

Symptoms on the part of the nervous system, so frequent in Bright's disease proper, are distinguished by their absence in amyloid

kidney. Bartels declares that he knew but one case of amyloid kidney to die of apoplexy. Hypertrophy of the heart does not occur.

The *diagnosis* rests upon the fact that amyloid disease is a general process, and that affection of the kidneys coincides with affection of the spleen, liver, and often of the alimentary canal. Besides the history of the case, the connection with some suppurative process, and the kidney symptoms mentioned, affection of the liver and spleen, recognized by enlargement of these organs, and of the alimentary canal by profuse and obstinate discharges, make the diagnosis clear. The diagnosis has been established in doubtful cases by harpoonage of liver or spleen substance under antiseptic precaution—a procedure which is justifiable only in the most exceptional case.

The *prognosis* in all cases of amyloid disease is bad. It is most favorable when dependent upon syphilis. Prevention by free evacuation of pus, and destruction or obliteration of pus-secreting surfaces, is the true treatment. Amputation, exsection, drainage, aspiration, are methods of prophylaxis and treatment of amyloid disease. The treatment of syphilis continued long after the subsidence of manifest signs, the thorough neutralization of chronic malarial poisoning, resort to change of climate in phthisis pulmonalis, prevent the development of amyloid disease. As to drugs, iodine alone is worthy of trial, because cases may depend upon concealed syphilis:

℞ Sodii iodidi..... ℥ i.
Aquæ menthæ piperitæ..... ℥ i.
M. S. Ten drops in a wineglass of milk three times a day.

Where iodine injures digestion, as it does sometimes, it should be discontinued until appeal may be made to the stomach with hydrochloric acid and bitters, condurango, nux vomica, tinctura rhei aromatica, etc.

TUBERCULOSIS.

Tuberculosis of the kidney is not common. It appears in the form of miliary tuberculosis, as part of the universal dissemination, sometimes confined to a single branch of the renal artery, sometimes widely diffused, and as a chronic local deposit in the substance of the kidney or in its pelvis. As is the case elsewhere, tuberculosis forms granules and nodules, which undergo caseous degeneration, or break down to produce necroses, ulcerations, and extensive infiltrations. The disease is sometimes recognized by the evidence of tuberculosis elsewhere, more accurately by the discovery of the tubercle bacillus in the urine. But tubercle bacilli must not be confounded with smegma bacilli, which look just like them. In case of doubt the prepared specimen should be immersed a few minutes in absolute alcohol, which decolorizes the smegma bacilli but not the tubercle bacilli.

SYPHILIS.

Syphilis of the kidney is even more rare. It shows itself in the hereditary form by intra-uterine arrest of development, and, after birth, with induration and shrinking. Now and then caseating gummata and cicatricial connective tissue are encountered in the kidneys of adults as the result of the acquired disease.

FLOATING KIDNEY.

Wandering kidney ; ren mobile.—The kidney is usually fixed in its position by the layer of fat in which it lies embedded, and is restrained within light latitude of movement by the vessels of the hilus, which, with the connective tissue that binds them together, constitute something of a pedicle. An unusual laxity of this tissue and of the abdominal walls, more especially compression from above, as by corsets, belts, etc., dislocates the kidney and allows it more or less wide range of movement. On account of the strain of hard work the condition is more common in the laboring classes ; and, on account of the mode of dress, more frequent in women than men. Sometimes both kidneys are thus dislocated and rendered movable ; when but one, the right more frequently than the left.

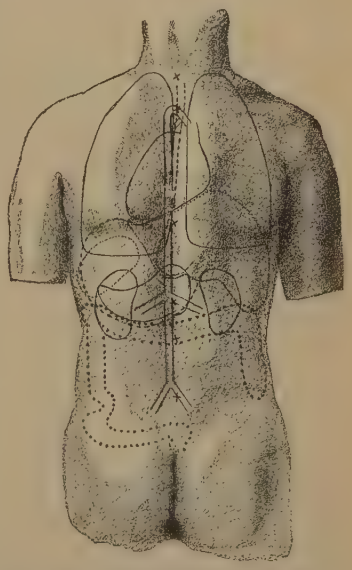


FIG. 269.—Topography of the kidney from behind, in relation to thoracic and abdominal viscera. Outlines of œsophagus, stomach, and large intestine in heavy dotted lines ; of liver and spleen in fine dotted lines ; of other organs in continuous lines. Crosses at seventh cervical, fourth and ninth dorsal, and first, third, and fifth lumbar vertebræ (Stedman). Compare with front view, page 583.

Symptoms.—In many cases the condition is entirely latent and is discovered only upon autopsy. There are no symptoms upon the part of the kidney itself, so far as concerns its function. The secretion remains the same. Attacks of dyspepsia, colic, icterus have been observed, and have been attributed to incarceration, which has, however, never been discovered upon the post-mortem table. They are better interpreted as neuralgias or as the result of a circumscribed peritonitis. More reliance may be placed upon *pain, dragging sensations, or sensations of displacement*, which are experienced as a rule. Sometimes a *tumor* may be felt, by bimanual examination, in the region of the kidney. In thin persons, in whom the kidney may be often

grasped in the hand, it may be recognized by its shape. It is felt to be mobile; is movable, especially upward, but may be seldom carried beyond the median line. It is usually extremely sensitive.

Diagnosis.—A floating kidney must be differentiated from a dislocated spleen or a small ovarian tumor. Aside from the fact that the left kidney is less movable, the spleen is larger, firmer, and much more superficial. The ovary differs in shape, moves downward rather than upward, may be recognized at times by a vaginal examination, or may be absolutely distinguished, in case of cystic growth, by aspiration.

The *prognosis* is favorable so far as life is concerned. Any radical correction of the displacement, except by surgical means, is difficult. The enforced idleness which results from aggravation of the pain by work sometimes conduces to melancholy.

Treatment.—Corsets, belts, must be abjured. Pads, compresses, and bandages may give mental, but rarely any real bodily, relief. Extirpation of the kidney, notwithstanding the fact that one is usually large enough for all the wants of the body, is justifiable only in extreme cases, or really only in cases of disease of the kidneys. Harris reported sixteen nephrectomies, with ten recoveries. The kidneys were found diseased in three of the six fatal cases. Krönlein lost a case on the fourth day after nephrectomy from insufficiency of the remaining kidney. Attempt has also been made to transfix the kidney with a ligature passed into the abdominal walls through the kidney and out again, without permanent benefit. Hahn simplified this operation by cutting down upon the kidney and stitching its capsule into the wound. Angerer cured seven of nine cases by fixation with catgut ligature. Such nephrorrhaphy is the proper procedure.

CHAPTER X.

DISEASES OF THE PELVIS OF THE KIDNEY, BLADDER, ETC.

KIDNEY STONE—NEPHROLITHIASIS.

Renal sand; gravel; calculus.—The old idea of a diathesis has been entirely abandoned, but stone in the pelvis of the kidney is still distinguished as nephrolithiasis. Nothing definite could possibly be known of the nature of stone in the kidneys until the discovery by Scheele (1776) of uric acid as a normal ingredient of urine. Scheele considered it the exclusive constituent of kidney stones. The discovery later of cystin, xanthin, oxalic acid, and the phosphates put the subject on solid ground.

Nearly all the stones found in the urinary apparatus originate in the kidney. The proportion of original renal to vesical stones is 100 : 1. There is great variation in size and number. A single stone may fill and form a cast of the pelvis of the kidney, or multiple stones—as many as one thousand have been counted—may distend the pelvis and ureter. Larger stones, as of the size of a goose egg, imply usury of the kidney substance. Gee described a case in which one thousand stones were found in the pelvis of the right kidney, one weighing 1,080 grammes, while the pelvis of the left kidney was taken up by a stone which weighed 100 grammes. The largest of these stones is the largest yet found. Kidney stones may be round, oval, angular, or irregular; they vary also in surface, color, and consistence.

Seven special forms have been described—stones of uric acid and urates, of oxalate of lime, of the phosphates, of the carbonate of lime, of cystin, xanthin, and indigo. Stones of the urates are hard, smooth as if varnished upon the surface, or granulated. They are usually small, varying in size from a poppy seed to a pea or bean. They are recognized by the murexide test. Scrape powder from the stone into a watch glass, or, better, a porcelain cover, add a drop of nitric acid, and heat to dryness. If now the brown spots of residue be touched with a drop of ammonia, there is developed in the presence of uric acid a brilliant carmine-red, the so-called murexide color. A drop of liquor potassæ changes the carmine to a

dark violet-blue. Oxalic-acid stones are distinguished by their extra hardness, as if varnished, dark color, and rough, warty surface; they form the so-called mulberry stones. Heated to redness they turn white and effervesce with acids. Phosphatic stones are usually combinations of the phosphate of lime and the triple (ammonio-magnesia) phosphates. They are small and light, gray in color, and sandy or granular upon the surface. Soaked in potash lye and heated to redness they develop the odor of ammonia. Cystin, xanthin, and indigo stones are very rare.

Cystinuria has now a new significance as a sign of infectious process. Recent investigations (Stadthagen, Brieger) go to show that

FIG. 270.—Crystals of oxalate of lime. In the middle the ordinary octahedra; at the sides, disc, hour-glass, and dumb-bell shapes. × 275. (Eichhorst.)

cystin is itself, or is the product of, a ptomaine in the intestinal canal, due to the action of certain micro-organisms. Cystin is found in the fæces and in the urine in connection with diamin. The acid urine decomposes the combination, the soluble diamin is discharged, and the insoluble cystin precipitated to possibly form a stone. Cystin is recognized by the fact that it occurs in small, colorless, hexagonal tablets (see page 184), which are easily dissolved in ammonia to be precipitated again on evaporation of the ammonia.

The *etiology* of kidney stone is obscure. Stones are found ten times more frequently in the male than in the female sex, and at both extremes of life rather than at maturity. Of 5,900 cases col-

lected by Civiale forty-five per cent occurred in children. The absolutely greatest number of cases occur between the ages of two and twelve. Sedentary and luxurious habits, conditions connected with climate, food, and drink, have been accused, without proof, of producing kidney stones. Uric acid and urates are frequently found deposited as yellowish-red stripes in the pyramids of the kidneys of new-born children, to present the appearance erroneously called infarction. It was believed that these deposits of the urates, as they occur only in consequence of tissue change, would be found only in children whose lungs had been expanded most abundantly, at two to twelve days after birth, and not, therefore, in the still-born. As

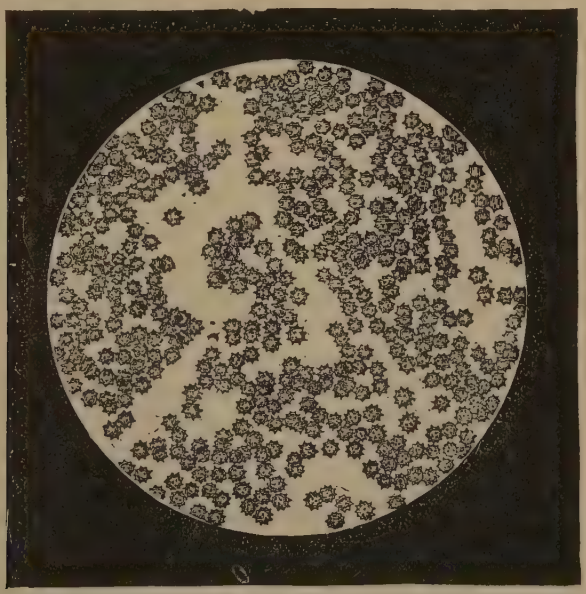


FIG. 271.—Mulberry-shaped red blood corpuscles in urinary sediment in hæmaturia (Eichhorst).

Hodann was able to demonstrate the condition in a decomposed kidney at the end of forty-five days, the finding assumed forensic importance. But as exceptional cases have been since reported, it may be said that the presence of this "infarction" constitutes not absolute but strong corroborative evidence of live birth. Concretions of uric acid may occur on account of excess of this substance in the blood or diminution of the salt which holds it in solution. Both conditions exist in certain cases. Individuals affected with gout may also suffer from kidney stones. Erasmus wrote to a friend: "I have gravel, you have gout. We have married twins."

The biphosphate of soda is the salt chiefly concerned in holding uric acid in solution. Diminution of this salt, the result of catarrhal inflammation of the pelvis of the kidney, may lead to the precipitation of uric acid. The phosphates fall in an alkaline urine, so that nephrolithiasis, so far as uric-acid and phosphatic stones are concerned—and they form the great bulk of cases—is always a local condition.

Symptoms.—The presence of kidney sand may give rise to no symptoms, but even minute concretions may cause excruciating pain. Stones passed from the bladder are often much larger than stones in the kidney or ureter.

Kidney stones usually reveal themselves by *pain*, which is excessive in its severity. The pain is *located in the region of the kidney, and radiates thence downward and inward toward the bladder.* It is so excruciating as to require the use of an anæsthetic, or large doses of opium, to secure relief. It is usually *fitful, and irregular* as the stone advances on release of spastic contraction, and often subsides suddenly with escape into the bladder, sometimes to leave the patient narcotized. The *urine* may appear perfectly natural, as it may issue only from the unaffected kidney, or it may be *tinged with blood or contain pus* from the affected kidney. *Hæmaturia and pyuria may thus alternate with perfectly normal urine.* Accordingly, *sediment may be scant or abundant,* and examination of the deposit under the microscope may disclose the presence and character of kidney stones. Sometimes, in consequence of complete occlusion, the kidney is converted into a retention cyst, to constitute a hydronephrosis. The kidney substance itself may be consumed and the capsule distended to such degree as to constitute a tumor in the abdomen. *Pyelitis* is a more frequent complication. Perinephritic abscesses may result. Under these conditions sepsis may set in.

The *prognosis* is always serious. The stone may rupture the ureter, whence peritonitis will develop. Abscesses with burrowing sinuses and fistulæ may lead to slow marasmus and amyloid change. Nevertheless most cases recover. Patients pass the stones once for all; more frequently a number of stones are passed in the course of a week or month, and the condition recurs once or twice in the course of a year. Sometimes the interval lasts several years.

The *treatment* consists in the flushing of the kidney with abundance of drink, especially water, mineral waters, alkaline waters. The waters of Saratoga and Bethesda, any of the pure simple alkaline waters of our own country, may suffice. Better results are secured by Carlsbad water, natural, or preferably, with us, the artificial salts. Lithia has long been used. Of late one of the coal-oil

products, piperazin, has been highly recommended. It is given in doses of gr. v.–xv. three to five times a day in a glass of soda or Selters water. It is said to have the power to dissolve uric-acid stones.

The treatment of the attack is the relief of pain by the inhalation of chloroform or ether, by the subcutaneous injection of morphia gr. $\frac{1}{4}$, preferably with atropia gr. $\frac{1}{100}$, and by the administration especially of chloral gr. xv.–xxx. to secure relaxation of spastic contraction and thus further the progress and final discharge of the stone or stones *per vias naturales*. Large flannels wrung out of boiling water and made to envelop the whole of the affected side assist in securing relaxation and relieving pain.

PYELITIS.

Pyelitis is an inflammation of the kidney produced by some irritating cause which develops *in situ*, or which escapes with the secretion of the kidney. The local cause is most frequently a stone—*pyelitis calculosa*—which may fret and irritate the pelvis and produce hæmorrhage, suppuration, and ulceration. The cause may come from below, as from the bladder, cystitis; or from gonorrhœa, the use of unclean catheters, etc. It is commonly a mycosis, and is typically illustrated in the pyelitis which occurs in connection with tuberculosis. Pyogenic micro-organisms may find their way from the ureter to the kidney. More commonly the mycosis comes from above. Thus pyelitis occurs in the course of the graver infections —typhoid fever, small-pox, scarlet fever, diphtheria, cholera, etc. The micro-organisms themselves may not escape, but may do their damage by their products, the toxines and toxalbumins. A proof of this process is found in the pyelitis which sometimes results from irritating drugs, cantharides, turpentine, copaiba, etc. Extension of disease from the pelvis to the substance of the kidney produces *pyelonephritis*, which may terminate in the formation of abscesses and finally convert the kidney into a sac of pus, *pyonephrosis*, or extend to envelop the adjacent tissue as a peri- and para-nephritis, often with the formation of abscesses. A stone may increase in size to form a cast of the pelvis or of the whole kidney. Much more frequently it remains small and produces pyelitis. The process is almost always unilateral. Stone is more frequent in the left kidney.

Symptoms.—Pyelitis is announced by *pain*, more dull than acute, and more often manifest by *sensations of tension and weight*. The pain usually radiates from the kidneys along the course of the ureters to the bladder. Pain is sometimes entirely absent. The best information is furnished by the urine, which contains *pus or blood*, or both, therefore *albumin*, and sometimes *characteristic epithe-*

lial cells. In a case of pure pyelitis the urine remains acid. Under retention from whatever cause, ammoniacal decomposition takes place with alkaline reaction. The cells are from the flattened cau-

Fig. 272.—Epithelial cells from mucous membrane of renal pelvis, with prolongations and a shingled arrangement, from intact mucous membrane in man. × 275.

date epithelium of the renal pelvis, and when present are pathognomonic. Unfortunately they are absent in many cases, as they are

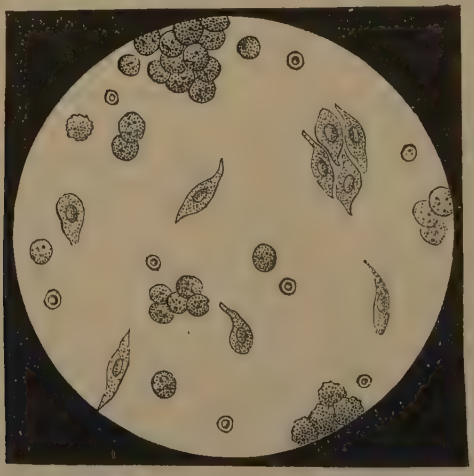


Fig. 273.—Urinary sediment in acute pyelitis, containing epithelium, round cells, and red blood corpuscles. × 275.

destroyed in ammoniacal urine. The presence of fever, with chills, diarrhœa, delirium, nervous signs, and the status typhosus, indicates pyelonephrosis or pyæmia.

The *diagnosis* rests upon the pain, if present; the presence of albumin, blood, or pus in the urine; more especially the characteristic epithelial cells; and, in connection with pyelonephrosis, the chills, fever, hebetude, and status typhosus. Pyonephrosis may form an abdominal tumor.

The *prognosis* is always grave, but in the individual case depends upon the cause. It may disappear entirely after the discharge of a kidney stone or cure of a cystitis. The prognosis in the course of infection is always grave. It is more favorable after typhoid fever, in which disease it usually disappears with convalescence, than after pyæmia, where it is often fatal. So long as the urine remains acid the outlook is good; with ammoniacal decomposition the course of the disease is usually downward.

Treatment consists in the removal of the cause, in the cure of gonorrhœa, the use of perfectly clean catheters, the removal of kidney stones. The administration of the salicylate of soda may prevent or postpone ammoniacal degeneration of the urine. The bladder may be washed out with disinfecting solutions of creolin, one-quarter of one per cent. When there is no obstruction fluids must be administered freely to keep the kidneys flushed. Bad cases may require nephrotomy or nephrectomy. Guyon reported the cure of six cases of pyonephrosis by nephrotomy. The opening into the kidney must be wide and deep.

HYDRONEPHROSIS.

Cysts occur in the kidney in consequence of dilatation of the urinary tubules. The dilatation is most frequently observed in consequence of hyperplasia of the connective tissue, which causes compression and accumulation. Such cysts vary in size from a pea to a hen's egg, and are filled with colorless or yellowish fluid, more or less gelatinous, from which the true elements of the urine have been usually absorbed. A peculiar degeneration, wherein the whole substance of the kidney is transformed into cysts which may assume magnitude by coalescence, is sometimes observed as a congenital malformation, to constitute the so-called cystic kidney. The same degeneration is sometimes observed in maturity and age, not infrequently accompanied by a corresponding cystic degeneration of the liver. Occlusions in the pelvis of the kidney or the ureter, which block the escape of urine, lead to *hydronephrosis*. Such occlusions are most frequently formed by kidney stones, more rarely by cicatrices, strictures, compression of outside organs, tumors of the uterus and ovaries, enlargement of the prostate, etc. The kidney substance suffers usury under the pressure of accumulating fluid; the capsule is distended to a sac which may contain from five to ten

pints of fluid. With the gradual disappearance of the kidney substance the elements of the urine are absorbed and substituted by mucus which contains albumin, colloid matter, and sometimes blood, which imparts to the fluid a brown color. The condition is sometimes congenital, and in the experience of the author once formed, in labor, an obstacle which could be overcome only by puncture of the abdominal wall. The child was still-born.

Treatment depends upon the cause, which must, as in the case of kidney stone, outside compression, etc., be discovered and removed. Surgical intervention may become a necessity.

FIG. 274.—Stone causing hydronephrosis (Roosevelt).

CYSTITIS.

Cystitis (*κύστις*, the bladder); inflammation of the bladder; catarrh of the bladder.—A disease distinguished by the presence of three symptoms, pain, frequency of micturition, and pyuria. Albumin is present only in small quantity in correspondence with the amount of pus.

Etiology.—Cystitis may develop by extension of disease from above or from below—that is, from the kidneys and ureters (pyelitis, calculus), and from the urethra (gonorrhœa, stricture, disease of the prostate gland). Cystitis may be also the local expression of tuberculosis and cancer, in which processes the disease may extend to the bladder from contiguous structures (uterus, rectum, etc.) or be car-

ried to it by the blood and lymph vessels. So, too, cystitis may develop in connection with an infection of the blood—pyæmia, septicæmia—when the cause of the disease may be discoverable, or the affection may be cryptogenetic. Paralysis of the bladder, from disease of the brain or spinal cord, trauma, tabes, etc., may produce cystitis from retention and decomposition of urine. A peculiar and rare form is attended with the formation of a false membrane, the pseudo-membranous cystitis.

Gonorrhœa is the most frequent cause. Cystitis occurs in the later course of gonorrhœa, often when the discharge is reduced to a gleet or to a single drop in the morning. The gonorrhœa is sometimes overlooked or unrecognized, as a posterior urethritis may develop without visible discharge. Posterior urethritis is detected by the presence of gonorrhœal threads in the urine first passed in the morning, and by the presence of the gonococcus in the mucus.

Fig. 275.—Cystitis with gangrene and separation of the mucous membrane and part of the muscular coat (Gardner).

Symptoms.—The disease is distinguished, as stated, by the association of three symptoms, *pain, dysuria* (frequency of micturition), and *pyuria.* Any one of these symptoms may occur in other affections; all three only in cystitis. The *pain* varies in every degree of intensity, from light distress to the most intolerable anguish. In acute cases it radiates from the bladder along the course of the urethra, involves the testicle and rectum, and is felt in intensity at the head of the penis. In these cases it is associated with intolerable tenesmus and dysuria. The desire to pass urine recurs every few minutes; but a small quantity, a drachm or two, is voided under the most intense effort; finally but a few drops of blood. The presence of *pus* is best observed in the urine which is passed first and last. With the development of cystitis the discharge of gonorrhœa usually ceases. The discharge should be examined repeatedly for the gonococcus of Neisser.

Tuberculosis is, as a rule, primary in the bladder; that is, the disease is derived from latent depots and not from the lungs. Tubercular cystitis is especially distinguished by the presence in the urine of blood, which shows itself suddenly and apparently spontaneously, without much pain or dysuria. Tuberculous cystitis is often associated with *polyuria.* The diagnosis is difficult because of the difficulty or impossibility of discovering the tubercle bacillus in the urine. In the absence of tuberculosis of the lungs, some expression of the

disease may be found elsewhere, as in the glands, joints, bones, epididymis, etc.

Calculus produces intense pain, frequent hæmorrhage, and tenesmus, which are all increased by exercise of the body and relieved by rest. The stone may be felt by the sound. Stricture is discovered by the passage of a sound or bougie. In the membranous form flakes or masses of exudation containing epithelial cells, or consisting of actual exfoliations from the bladder itself, are voided with the urine or withdrawn by the catheter.

Treatment.—Cystitis may be prevented by the prompt and proper treatment of gonorrhœa, with the avoidance of strong injections at the start, by the use of clean catheters in retention, by the dilatation of strictures, withdrawal of stones, etc. Rest in bed is an essential factor. Hot drinks, tea, milk, mucilaginous drinks, are the best. The diet should be light and the bowels should be moved every day. Copious draughts of warm fluids flush the bladder. Pain may be relieved by hyoscyamine gr. i.–℥ i., gtt. iij.–v. every three or four hours, or atropia in the same solution and dose. Warm baths constitute the best remedy for dysuria. The injection of hot water into the rectum during the bath heightens the effect. More obstinate cases yield only to opium (gr. i.) suppositories, or opium with extract of belladonna gr. ss., or rectal injection of tincture of opium gtt. x.–xv. with starch water. Dysuria which amounts to strangury requires a suprapubic subcutaneous injection of morphia.

Gonorrhœal cystitis is often cut short by the administration of copaiba or the oil of sandalwood in capsules containing gtt. v.–x. every two to four hours, or by the use of salicylate of soda:

℞ Sodii salicylatis ..... ʒ ij.
Glycerinæ ..... ℥ i.
Aquæ menthæ piperitæ ..... ℥ iij.
M. S. Tablespoonful every three hours.

Chronic cystitis calls for irrigation of the bladder with solutions of boric acid three to five per cent, of sublimate 1 : 20,000 to 1 : 10,000, creolin one-quarter of one per cent, nitrate of silver one per cent, etc. Astringent effects are best secured by the use of solutions of alumnol one per cent, sulphate of zinc one-tenth of one per cent, tannin one-tenth to one-half of one per cent.

ENURESIS (INCONTINENCE OF URINE).

Incontinence (*in*, negative, *continere*, to hold) of urine occurs especially at the extremes of life, in age and childhood, and depends, aside from organic disease, upon overdistention from paresis of the detrusor with continuous discharge, or defective closure from paresis of the sphincter.

Incontinence is frequent in women from dilatation of the urethra with relaxation of the sphincter in consequence of the strain and trauma of parturition. Involuntary dribbling or discharge occurs readily in such cases with coughing, sneezing, any exercise of the body. Masturbation may produce the same effect. Incontinence is frequent, too, in old men on account of atrophy or affection of the prostate gland (Peyer). Great care must be taken in all these cases not to mistake an overflowing for an empty bladder. The urine dribbles from a distended as well as from a paralyzed bladder. The most disastrous, even fatal, accidents have resulted from this mistake. The use of a clean catheter will at once clear up any doubt.

Enuresis (*ἐν*, in, *οὖρησις*, passing water) is the involuntary, and usually unconscious, discharge of normal urine from a normal bladder. Enuresis is a neurosis of the sphincter, and is for the most part a persistence of the infantile state, where the resistance of the sphincter is very slight. So enuresis is most frequent at night, when the influence of the will is withdrawn by sleep and the innervation of the sphincter is defective. The condition shows itself especially between the ages of three and ten, sometimes not until puberty, and then at times in connection with onanism.

Treatment.—Inspection occasionally reveals verrucosities or polypoid excrescences at the orifice of the urethra in girls, the exsection or cauterization of which relieves the condition. Debilitated children must be built up with quinine, iron, cod-liver oil, and especially with exercise in the fresh air. Cold baths contribute to fortify the body in this regard. Atropia gr. i.–ʒ i., gtt. iij. at bedtime, is the remedy of most value. It must be given with great caution to delicate children, and gradually increased to tolerance, not beyond dilatation of the pupil. The most effective treatment is the use of electricity, which is safely brought into indirect contact with the sphincter through the rectum. The current should be feeble, scarcely perceptible, and may be gradually increased to tolerance with sessions of five to ten minutes every other day. Treatment usually requires a period of four to five weeks. Exceptional cases are very obstinate.

SPERMATORRHŒA.

Spermatorrhœa (*σπέρμα*, sperm, *ῥέω*, to flow), an abnormal discharge of semen. An overflow which may occur once or twice a month is not disease. The condition becomes pathological when the discharge is more frequent. In this regard individuals differ, and each man is, in a manner, a law unto himself. The abnormity consists not so much in the frequency as the effect. The physiological overflow is followed by a sense of relief; an excess, by exhaustion.

Spermatorrhœa is for the most part a misnomer. In many cases

the discharge is not semen, but secretion from the prostate and accessory glands. Prostatorrhœa is often a more appropriate name. The secretion, with few exceptions, may be declared to be semen when the fluid contains spermatozoids (vide page 184, Fig. 127, 3). In the few exceptions these structures are absent (vide Impotence).

The loss occurs chiefly with the discharge of urine and with the act of defecation. In the urine it is seen more especially at or just after the end of micturition. The patient may be unaware of its escape, and recognize it or suspect it only from the turbidity of the urine, or the physician may come upon it in the examination of the urine or its sediment.

With the discharge of fæces it is always visible, as the seminal fluid is expressed by the mass of fæces itself. In more aggravated cases the patient is able to express the fluid, or comes to the physician with the statement that he feels its passage or presence, sees it at the orifice, and knows it to be semen by its greasy or "soapy" feel.

Etiology.—Masturbation is the most frequent cause of spermatorrhœa. Sexual excess also finally renders the nervous system irritable. Posterior urethritis, inflammation of the prostatic portion of the urethra, involving especially the caput gallinaginis, due chiefly to gonorrhœa, constitutes a constant irritation. An elongated prepuce, a natural or acquired phimosis, which retains secretion; abnormal states of the rectum and anus, constipation, ascarides, eczematous eruptions, hæmorrhoids, are outside irritants which may much more exceptionally excite the genital centres.

Symptoms.—Besides the presence of the *discharge*, the nature of which may be demonstrated by the microscope, a real spermatorrhœa is attended with a sense of *weakness, languor, and depression, with various paræsthesiæ and vaso-motor disturbances, flashes of heat, vertigo, and headache.* Most persons are affected with hypochondriasis and melancholia, conditions which are produced rather by degrading habits—onanism, sexual excesses, and perversion—which cause the spermatorrhœa, or are intensified by the perusal of popular literature regarding the disease. *Dyspepsia, palpitation, and dyspnœa*, dependent upon anæmic conditions of the blood, occur later in the course of the affection.

Diagnosis.—True spermatorrhœa shows spermatozoids in the discharge. Prostatorrhœa furnishes a thin, milky fluid of characteristic spermatic odor, containing numerous lecithin granules and crystals of the phosphates (sperm crystals), which fall in abundance on the addition of a one-per-cent solution of ammonium phosphate. Prostatorrhœa furnishes no spermatozoids.

Phosphaturia, a secretory neurosis, or a deposit from local cause, a condition without any real clinical significance, sometimes imparts

to the urine a turbidity or a milky color which is cleared up at once on the addition of a few drops of acetic acid.

Treatment consists in regulation of the habits, abstention from masturbation and sexual excesses, relief of dyspepsia and gastric catarrh, the education of the mind to a better tone. Matrimony is the most effective remedy; as a rule it renders all others superfluous. Hydrotherapy—a cold bath every morning, especially a cold douche—invigorates the nerve centres. A dose of the bromide of potassium, gr. xx.–xl. in a glass of water at bedtime, may subdue the excitability of the nerve centres and prevent nocturnal pollution. Posterior urethritis is best treated by injections of nitrate of silver, one to three per cent, with the catheter, after the manner already described. Electricity in both forms, faradization and galvanization, short sessions and feeble currents, often furnishes good results.

Spermatorrhœa is usually found in connection with onanism, sexual excess, often with sexual perversion, in victims weakened by self-indulgence. The treatment calls for the exercise of much patience and tact. The physician may accomplish more by elevating the standard of morals than by prescribing drugs. The condition of many of these patients is pitiful. They have been led to believe that their lives are wrecked. They are finally frightened at shadows. They may be led out of these delusions only by kindness and encouragement. Ridicule or contempt drives them back to the charlatans, vampires who feed on the miseries of their fellow-men.

IMPOTENCE.

Impotence (*impotens*, powerless) is a relative or absolute incapacity for natural coitus. It depends upon physical, toxic, and psychical causes. Sexual potency, which is wholly relative and varies in degree in the same individual, depends on the integrity of a reflex loop to and from a special centre in the lumbar cord, but the activity of this centre depends, in turn, on cerebral and reflex influences. Cerebral centres normally exercise over the spinal centre inhibitory or controlling effects. In the absence or alteration of this influence the spinal centre acts to excess to produce priapism. Thus section or destruction of the cord above the lumbar region is often followed by powerful and continuous priapism, because the inhibition from the brain is cut off. Sometimes the inhibition is too strong and psychical influences prevent erections altogether (impotentia psychica). This control, or lack of control, is partly a matter of original endowment, and partly of habit. It is, at first at least, largely a matter of self-denial or self-indulgence. The originating or reinforcing centres in the cerebrum may be cultivated to such degree

as to entirely overcome the inhibiting centres and make a man "a slave to his passions."

Etiology.—Physical causes include malformation and defects, atrophy, tumors, etc., which belong to the domain of surgery. Cryptorchism (κρυπτός, concealed—*i.e.*, undescended—ὄρχις, testicle) causes impotence only when both glands are atrophied. Mere retention in the abdomen or in the inguinal canal is not incompatible with potency. Among physical causes are to be included also the effects of certain diseases of the brain and cord, the degenerations, and of all diseases which produce marasmus. Maladies which show impotence as an early sign are diabetes, diphtheria, and tabes dorsalis, and all cases should be studied first with reference to the existence of these affections. Tuberculosis pulmonum is an interesting exception to the rule that diseases marked by marasmus are attended with impotence. By far the most common physical cause is excessive venery or abuse, onanism. Regarding excess the rule of Luther may be remembered: "*In der Woche zweier macht im Jahr ein hundert vier*" (twice a week is one hundred and four times a year).

The most common cause of sterility in the male is gonorrhœa, which blocks the efferent vessels and shuts off the spermatozoids.

Toxic influences are the effects of certain drugs, alcohol, the bromides, the iodides, opium, camphor, salicylic acid, lupulin.

Psychical causes are fear of failure, despair, dislike, aversion. Sexual perverts are often impotent with virtuous wives. The condition shows itself, as an impotentia coeundi, in absence of desire, absence or incompleteness of erection, premature discharge; and, as an impotentia generandi, in absence (aspermatism), diminution, or alteration of the seminal fluid, which when present may be scanty, watery, purulent, or bloody, and may contain motionless (azoöspermia), few, or no spermatozoids. Gonorrhœa with epididymitis and occlusion of the vas deferens is, as stated, the most common cause of the last-mentioned condition.

The *prognosis* is much more favorable in cases of psychical and toxic impotence than in the presence of defects or paralysis.

Treatment.—Fear of failure is generally relieved by resolution with efforts at complete abstention. Excesses are usually cured by continence. In all cases the most essential element in the treatment of impotence is *rest*. Defective innervation, including anæsthesia at the sensory surface, is best stimulated by strychnia gr. $\frac{1}{40}$–$\frac{1}{12}$, and electricity, faradization and galvanization, with the negative pole at the spinal centre and the positive, urethral electrode introduced into the prostatic portion to the sensory (sexual) surface at and about the orifices of the seminal ducts. Aphrodisiacs, including cantharides, act only by irritation and suggestion. Suspension with extension of

the spinal column, not longer than five minutes a day, often relieves the impotence of locomotor ataxia. The deep injection of a strong solution, three to five per cent, of nitrate of silver is a powerful stimulant.

The treatment of the psychical features or effects of impotence is the same as that of spermatorrhœa.

DIABETES MELLITUS.

Diabetes (*διά*, through, *βαίνω*, to go) mellitus (*μέλι*, Latin *mel*, honey).—A disease characterized by increase in the quantity of urine, and the continued presence of sugar in the urine, with disturbed nutrition, marasmus, liability to sudden coma, and a tendency to tuberculosis. The disease receives its name, diabetes, from the first of these signs, the increased flow of urine. It is, however, often recognized in the absence of this sign, and the quantity of urine may vary to fall even below the natural amount in the course of, especially at the close of, the disease. The presence of sugar in the urine does not necessarily imply diabetes. Transitory glycosuria is common. It is only when present in a certain amount, or more especially when persistent, that sugar in the urine indicates the disease diabetes. A variety distinguished by an increase in quantity, without sugar, is known as a special form—diabetes insipidus.

History.—Celsus recognized the disease as a dangerous affection, marked by increase of urine and emaciation. Aretæus named the disease "diabetes" and considered it a disease of the stomach. Galen located it in the kidneys, Sylvius in the blood. All this time the disease was known only by its main symptom, diabetes; and, though the Indian physicians were familiar with the fact that the urine contained sugar, which they recognized by the taste, this fact was not known elsewhere until it was discovered by Thomas Willis (1674). Dobson (1775) seems to have been the first to obtain sugar from the urine, and with Pole, Home, and Cowley (1778–1788) to thus really distinguish the disease. Rollo (1797) now made the discovery, of inestimable value, of the relation to diabetes of vegetable food, which he banished from the dietary of patients in the treatment of the disease. Ambrosiani (1835) first demonstrated the presence of sugar in the blood, which Mialhe attributed to the diminished alkalescence of the blood, recommending the administration of alkalies to substitute the deficit. Bernard (1850) produced sugar in the urine by a puncture of the floor of the fourth ventricle, and seemed to have established a nervous origin of the disease. Frerichs and Von Recklinghausen (1866) remarked upon the frequency in diabetes of disease of the pancreas, which later writers bring in close connection with the origin of the disease.

Etiology.—Diabetes has been attributed to disease of the stomach, kidneys, blood, nervous system, and pancreas. It has certainly been observed in connection with alterations of these various organs, but also without discoverable lesions in any. The real pathogeny of diabetes is unknown. The disease is three times as frequent in men as in women, and occurs with especial frequency from twenty to fifty. Yet cases are occasionally observed in childhood, even as early as the first year of life ; and in age, even over seventy. Hereditary influence is sometimes pronounced. The disease is more frequent in the upper classes. The obese are especially predisposed ; according to Pfeiffer thirty-three per cent of the obese become diabetic. Diabetes has been observed to occur after traumata, especially after violent contusions or concussions involving the nervous system ; in the course of or after nervous diseases, insanity, epilepsy, tumors, aneurisms, etc. ; after emotional disturbances, fright, grief, anxiety ; and in the course of convalescence from infectious diseases, especially malaria. The disease in these cases is said to be symptomatic.

Pathogeny.—The sugar which appears in the urine is derived from two sources : 1, from the food directly, or indirectly through the glycogenic function of the liver ; 2, from the blood, from transformation of the fats and albuminoids. In the first case the sugar disappears entirely upon absolute withdrawal of sugar and starch from the food; in the second case the sugar, though diminished in amount, still remains. Thus are to be distinguished two forms of diabetes.

Morbid Anatomy.—No constant lesion is found in connection with diabetes. In the majority of cases nothing abnormal is found in the nervous system, including the vagus and the sympathetic. The liver is usually enlarged, but solely on account of hyperæmia. Statements concerning hyperplasia of liver cells and connective tissue are to be received with reserve. The kidneys are usually increased in size, also on account of hyperæmia. The epithelium of the urinary tubules shows sometimes diffused inflammatory, more rarely fatty, change. The pancreas is affected more frequently. In nearly one-half of the cases it is found in a state of atrophy or degeneration. The disease of the pancreas has been attributed to affection of the cœliac plexus, which has also been considered a common cause of the disease of the pancreas and the diabetes.

Symptoms.—Diabetes sets in insidiously, and, though usually preceded by dyspepsia and nervous signs—anorexia, nausea, headache, insomnia—is commonly recognized only when the patient notices *an increase in the quantity of urine and thirst.* Increased frequency of discharge is usually first observed at night, on account of the preoccupations of the day ; the quantity may vary from four pints to four quarts in twenty-four hours.

The *urine* is clear, light in color, and free of sediment. It foams readily on shaking, and the foam persists. *The reaction is always acid.* The distinctive feature is the increase in its *specific gravity* up to 1030–1040, or even 1060. The specific gravity corresponds in a general way to the quantity of sugar and other solids present. A great excess of water may show a light specific gravity, 1008–1010, even in the presence of sugar. The quantity of sugar usually ranges at two to five per cent, but varies from the minimum, one-half of one per cent, to the maximum, ten per cent.

For clinical purposes sugar is recognized by one of the following *tests:*

1. *Moore's Test.*—To the urine in a test tube is added one-fourth of its volume of liquor potassæ; the upper part of the fluid is *thoroughly* boiled. The presence of sugar is revealed by a brown color. The addition of an acid develops the odor of burnt sugar (caramel). The absence of coloration after thorough boiling is reliable negative—*i.e.*, exclusive—evidence.

2. *Trommer's Test.*—A ten-per-cent solution of sulphate of copper is let fall into the test tube containing the urine, drop by drop, so long as the copper dissolves. Liquor potassæ is added in amount equal to the whole amount of fluid. The mixture is then slowly heated. The alkali, in the presence of sugar, deoxidizes the copper and precipitates the salmon-colored suboxide. The coloration should show before the boiling point is reached. It continues after cooling. When the quantity of sugar is small the test is rendered uncertain by the fact that uric acid and kreatinin show the same reaction.

3. *Nylander's Test.*—Dissolve four grammes of Seignette salt in one hundred cubic centimetres of eight-per-cent potash solution, heat (but not to the boiling point), and add as much subnitrate of bismuth as will dissolve (about two grammes). Let cool; filter. The clear solution is ready for use.

Add one part of the Nylander solution thus prepared to ten parts urine. Boil for a few minutes. In the presence of sugar the mixture becomes first brown, then brownish-black or black from diffusion of the bismuth, which gradually sinks as a sediment. Minimal quantities require long boiling, five minutes, to precipitate a grayish sediment, a mixture of earthy phosphates and bismuth.

The test of Nylander is among the most delicate and reliable of all. It discovers sugar in an amount as small as one-tenth of one per cent, and nothing natural to the body but sugar will give the reaction. Moreover, it is easily prepared and keeps almost indefinitely (Gräber). It must be remembered, however, that certain drugs, the various modern antipyretics, with salol, senna, turpentine, will give the same result.

4. *Fermentation Test.*—Three test tubes are filled two-thirds full of mercury. To the first are added the suspected urine and pure yeast; to the second, normal urine with yeast; to the third, a dilute solution of sugar in yeast; and to each tube a drop of solution of tartaric acid. All three tubes are now inverted, under cover of the thumb, into a vessel of mercury. The accumulation of carbonic acid gas at the top of the first and third tubes shows the presence of sugar. The second tube shows no displacement of its fluid. The quantity is roughly estimated by the specific gravity, provided the quantity of urine is increased; more accurately from the difference in the specific gravity before and after the fermentation test.

1. The rule runs: Divide the last two figures of the specific gravity by 4, and subtract from the quotient 1 or 2, according to the quantity of urine, the lesser number for a large quantity. Thus a specific gravity 1032 would give $32 \div 4 = 8 - 1$ or $2 = 6$ or 7 per cent.

2. Multiply the difference of fermentation by 0.22; the sum is the percentage of quantity. Thus, specific gravity before fermentation 1032, after 1004, difference 28; and $28 \times 0.22 = 6.16$ per cent.

The sugar commonly present is the variety known as grape sugar. Sometimes the urine contains other forms of sugar—inosite and levulose. Sometimes the urine contains products of fermentation, alcohol, diacetic acid, and acetone, which is recognized by the Burgundy-red color struck on the addition of the chloride of iron. The urine may also contain albumin. The quantity of urea is markedly increased. The discharge of urine may be so frequent as to harass the patient. This is especially the case in childhood, where the sleep may be disturbed. Enuresis nocturna should always excite suspicion of diabetes.

The *thirst* stands in correspondence with the quantity discharged. It is sometimes associated with a feeling of dryness, and is often insatiable. Suspicion of the existence of the disease may be excited by the constant endeavor of the patient to moisten the lips with the tongue. The gums are sometimes swollen; they may bleed easily; the teeth may become carious. The appetite is usually disturbed; it may be voracious and yet fail to satisfy. The bowels are constipated. Nervous symptoms may assume prominence. There is usually *progressive degradation of health and strength;* it is remarked in loss of energy, headache, disturbances of sensation, formication, other paræsthesiæ, severe neuralgia. The expression is usually nervous, anxious, troubled. A prominent symptom is *impotence;* patients frequently present themselves for treatment of this symptom, which is found to rest upon diabetes. *The knee jerk is diminished or lost.* Impotence, in association with absence of knee jerk, often leads up to the recognition of diabetes. On account

of the excessive excretion of water *the skin is dry and scaly. Pruritus*, especially pruritus vulvæ, is often distressing and obstinate, and scratching in its relief easily breaks the surface. A tendency to *furunculosis* is common, and the frequent occurrence of boils should always lead to examination of the urine. More extensive phlegmonous inflammations, even gangrene, occur in individual cases. The surgeon hesitates to operate upon the diabetic patient. *Cataract* occurs in five to ten per cent of cases, more especially in advanced stages. The opacity of the lens is not due to loss of water, as was formerly believed, but to disturbance of nutrition.

A peculiar *coma* is liable to supervene in the course of diabetes. It is the gravest of the nervous complications—in fact, is usually fatal. The patient, in the midst of his usual health, or that condition of it which belongs to diabetes, falls into somnolence and stupor, finally into coma. The coma supervenes sometimes suddenly, and is attended with heart failure and collapse. In other cases it is preceded by nervous disturbances, headache, unrest, anxiety. It is commonly marked by a characteristic deep-sighing respiration, often by cyanosis. Occasionally the breath has a peculiar odor, sometimes fruity, sometimes suggestive of chloroform. The coma is attributed to an acid fermentation of the blood with the development of acetone, because it has been observed that the urine strikes the Burgundy-red color with the chloride of iron. But neither acetone nor other product of decomposition has yet been discovered in the blood. This complication may put an end to life in twenty-four hours, more frequently in the course of three to five days.

Along with the general degradation of tissue connected with the formation of carbuncles, necroses, and gangrene, is a tendency to *tuberculosis*. Diabetes fertilizes the soil for the growth of the tubercle bacillus. One-half of all cases of diabetes succumb to tuberculosis.

Course.—Diabetes is a chronic disease of varying duration. Cases are distinguished as diabetes acuta and even acutissima, which may run their course in a few weeks or months. The disease usually lasts from three to fifteen years; the average duration of life ranges about five years. Forms are differentiated as light and severe, according as the symptoms may be controlled or not by diet. After the study of one thousand cases Seegen still insists upon this classification of cases. In the lighter form sugar disappears from the urine with abstinence from starch and sugar in the food, while in the severer form the sugar still persists. There are, he still maintains, no mixed or other forms. The disease advances rather in stages than continuously, with periods of remission and exacerbation.

The *prognosis* is always grave. Diabetes is not yet a curable disease. But the immediate outlook depends upon the form of the disease. Patients may in the lighter form live to die of old age, while life is always cut short in the graver forms. Diabetic coma is always an ominous sign, and tuberculosis has far greater gravity when it develops in the course of diabetes.

The *diagnosis* depends upon the increased urine and the presence of sugar. Sugar exists naturally in the blood in very small amount (0.1 to 0.3 per cent), and has been found in health in very minute quantities even in the urine. The existence of 0.3 per cent of sugar in the urine suffices to produce all the signs of grave diabetes (Abels). It is the persistence of sugar in the urine in distinct quantity that distinguishes diabetes. The general degradation of strength, dyspeptic signs, pains and paræsthesiæ, furunculosis, pruritus, disturbances of vision, excite suspicion of the existence of diabetes, which can only be declared positively by the discovery of sugar in the urine.

Treatment is mainly a matter of diet. Sugar and starch must be withheld. The food should consist largely of milk and meat, every form of which, in fish, flesh, and fowl, may be allowed. Vegetables which contain much starch must be taken sparingly or put under ban. Certain vegetables may be given freely—lettuce, cress, made into salad; cucumbers, tomatoes (raw), spinach, asparagus, string (green) beans, cabbage, and cauliflower. But beets, peas, beans (butter beans and dried beans), potatoes, corn, rice, cereals, are prohibited foods. Coffee and tea may be sweetened with a pinch of saccharin, which is three hundred times as sweet as sugar and does no damage. Levulose is said to be a sugar which acts without injury as a food. The denial of bread and potatoes becomes a punishment. Patients crave bread. The so-called health foods—flour from which the starch has been removed, almond flour, etc.—are poor substitutes. It is better to allow small quantities of bread regularly or occasionally. The object in the treatment of diabetes is not so much to secure urine free from sugar as to maintain the patient in a state of health, as near as may be. It is better to maintain the health with a certain glycosuria than to lose it without glycosuria. Of forty-nine cases treated by Liebermeister under withdrawal of all carbohydrates, the sugar disappeared entirely in twenty. In seven of these cases it reappeared with return of the patient to the use of starchy food; in two, only when the food was taken in excess; in five, only when white bread was taken in quantities exceeding four ounces per day.

Drugs can accomplish little. Opium distinctly reduces the quantity of sugar and diminishes the quantity of urine; but it also dis-

turbs digestion, and may therefore be resorted to only temporarily in extreme cases. In prolonged use its evils counterbalance its good. Pavy preferred codeine in dosage increased from three to thirty grains a day. But the same objections as to opium apply eventually. Rational therapy is out of the question until the nature of the disease is understood. On account of the acid condition of the urine and the assumed reduced alkalinity of the blood, alkalies, especially in the form of mineral waters—Vichy and Carlsbad—may be administered freely. The salicylate of soda or salol, ten to fifteen grains four times a day, may be given with much temporary benefit. Arsenic, Fowler's solution, gtt. iij.–v. three times a day, best supports the general nutrition. Dyspeptic signs are relieved by regulation of the diet. Nux vomica, tincture, gtt. x.–xx., is indicated in failing appetite. Thirst may be relieved by drinking less water at a time, frequent washing of the mouth, the use of ice pills, and chloroform gtt. ij.–iij. In diabetic coma the blood may be saturated with alkalies, especially the bicarbonate of soda. The salt solution (common salt one drachm, bicarbonate of soda gr. xlv., water one pint), sterilized by heat and cooled to 100° F., may be introduced into the veins. Diabetic patients should dress warmly, guard against exposure, and avoid both inactivity and excess. Travel aggravates the disease.

DIABETES INSIPIDUS.

Diabetes insipidus is an increase in the quantity of urine without the presence of sugar—a polyuria without glycosuria. But every polyuria does not constitute this form of diabetes, for polyuria is a necessary result of the ingestion of large quantities of fluid. Excesses of fluid—water, milk, beer—are discharged in this way. Polyuria occurs also in connection with certain forms of kidney disease—renal cirrhosis, where it is due to disease of the glomeruli, as well as to increased forcing power of the heart. Bernard found that irritation of a point in the floor of the fourth ventricle a little above the diabetic point produces polyuria without glycosuria. On this account the disease has been referred to nervous origin and considered a subvariety of pure diabetes. But diabetes insipidus has nothing in common with diabetes mellitus, except increased quantity of urine ; for diabetes insipidus is not attended with the general signs—dyspepsia, neuroses, pruritus, cataract, marasmus—of diabetes mellitus.

In the present stage of knowledge diabetes insipidus is considered a vaso-motor neurosis, probably of central origin.

Etiology.—Notwithstanding the essential difference in the nature of the affections, the same obscurity surrounds the origin of diabetes insipidus. The condition has been noticed to occur in the

course of organic brain disease after trauma and emotional distress. It has also been attributed to exhaustion and exposure to cold. The influence of heredity is sometimes marked. Weil reported twenty-three cases of diabetes insipidus in a family whose various branches numbered ninety-one persons. The disease is more frequent in the male sex and about the period of maturity.

Symptoms.—The symptom is the *increase* in the quantity *of urine*, which may be slight or great. The quantity may vary from four pints to four quarts, and not infrequently exceeds this amount. The urine is clear and light, 1005 and less. Thirst increases in correspondence with the loss of water, though it is not so intense and insatiable as in diabetes mellitus. The secretion of sweat, including the insensible perspiration, is reduced or arrested—a point of great value in differential diagnosis, for the action of the skin is unaffected in the polyuria of health, hysteria, etc. The general health may be sustained throughout. The disease is chronic and runs its course with remissions and exacerbations. It is often arrested for months at a time and is not infrequently absolutely cured. Treatment consists in regulation of life. Water must be taken frequently rather than abundantly. Opium has the same effect as in true diabetes in producing immediate effect with the same remote evil. Ergot sometimes controls the condition. Antipyrin, antifebrin, and agents of this class quickly reduce the secretion. The preparations of zinc, the lactate and valerianate, sometimes exercise more permanent effects. Arsenic in the form of the common potash solution, gtt. iij. ter die, or with bromide, as the solution of the arsenite of bromine, in the same dose, should be given faithful trial in every case.

DISEASES OF THE NERVOUS SYSTEM.

CHAPTER XI.

DISEASES OF THE NERVES AND MEMBRANES.

Diseases of the nervous system are distinguished as organic with discoverable, and functional with undiscoverable, lesions, and make themselves manifest by alteration of sensation, as abnormities, parræsthesia; loss, anæsthesia; increase, hyperæsthesia; pain, neuralgia; disturbance of nutrition, trophic change; alteration of motion; spasm, contraction, paralysis, abnormity of reflex; affection of special sense, intellectual faculties, and of consciousness.

NEURALGIA.

Neuralgia (*νεῦρον*, nerve, *ἄλγος*, pain), pain of nervous origin.—A symptom, not a disease, due to affection of the nerve at its centre, in its course, or at its distribution. The lesion may be gross and discoverable (*i.e.*, organic) or merely molecular (*i.e.*, functional).

Etiology.—Neuralgia may depend upon irritation of the nerve by trauma, exposure of the nerve (toothache), or pressure. Wounds of all kinds, aneurism, hernia, exostoses, cicatrices, etc., may be the exciting cause. More frequently neuralgia is due to poisoning of the blood by infection (malaria), products of inanition, exhaustion as from anæmia, chlorosis, loss of blood. Neuralgia is rare in childhood, and is much more frequent in women than men.

Symptoms.—As the name indicates, neuralgia is distinguished by pain, which varies in every degree of variety from a dull headache to the excruciating paroxysms of tic douloureux. The pain is confined to the nerve affected, trigeminus, sciatic, etc., or irradiates from its origin in various directions, as in angina pectoris. It is sometimes reflected or projected to a distant point, as in pain of the knee from coxalgia. Severe paroxysms are attended by general distress, nausea and vomiting, sinking signs, sometimes by muscular spasm.

Severe pain is paroxysmal for the reason that sensation becomes exhausted for a time.

Neuralgia of the TRIGEMINUS occurs in its various branches as supra- and infra-orbital and as supra- and infra-maxillary neuralgia. Painful points may be detected on pressure at the orifice of exit of these various branches. Infra-orbital neuralgia occurring in paroxysms causes the excruciating pain in the side of the face known as *tic douloureux*. Supra-orbital neuralgia is most frequently due to malarious or rheumatic cause. The other forms may be caused by affection of the teeth, pressure upon nerve trunks, degenerative lesions of ganglia or nerve cells at their deep origin.

OCCIPITAL NEURALGIA, manifested by pain in the back of the head, is also a common expression of malaria or other toxæmia. Typical cases have been observed in connection with the absorption of toxic substances from the uterus and prostate gland or posterior urethra.

INTERCOSTAL is a common form of neuralgia. It is usually felt in the neighborhood of the nipple, and more frequently upon the left side. It is a common expression of Bright's disease, but may be due also to malaria, where it must be distinguished from rheumatism, and to tuberculosis, where it must be distinguished from pleurisy. Intercostal neuralgia distinguishes itself by its three *painful points:* (1) near the spine, where the nerve issues from the intervertebral foramen; (2) near the axillary line, where the nerve becomes subcutaneous; (3) near the sternum, where the terminal branches become subcutaneous. An eruption (herpes) in the course of these nerves is not uncommon.

SCIATICA.—Pain in the course of the sciatic nerve is so frequent as to be considered as a separate affection. It is sometimes evidence of organic disease, especially of caries of the vertebra, and the simple neuralgic affection must be distinguished from the pain of pressure, as from coprostasis, tumor, aneurism, etc. The cause of sciatica is often obscure. It is more frequent in men than women, and in the lower classes where the condition is often confounded with rheumatism. Sciatica is much more frequently excited by local cause, cold and damp, and is much less frequently due to general cause, malaria, Bright's disease, etc. Painful points may be sometimes discovered, especially in the neighborhood of the tuberosity of the ischium; in the course of the trunk of the nerve; lower, in the ham, behind the head of the fibula, over the foot. It is sometimes attended with cramp, and is more frequently than any other form associated with atrophy of muscle. The pains of sciatica are, as a rule, more continuous than acute, and stand in closer relation than other forms to climatic change.

Coccyodynia is an obstinate neuralgia of the coccygeal plexus, which occurs especially as a traumatic lesion in connection with parturition, less frequently from unknown cause, exposure to cold, etc. It may be so severe as to require resection of the nerve or even extirpation of the coccyx.

Headache (cephalalgia) is the most common of all the forms of neuralgia, and may be an expression of all the multitude of causes which may produce neuralgia in any form. Headache announces the advent of the acute infections. Persistent headache in an individual previously free from it should excite suspicion of Bright's disease. A localized, circumscribed point of pain (clavus) is a frequent expression of hysteria.

A special form, of periodic occurrence, found usually in connection with disturbance of the stomach, constitutes the variety known as *sick-headache* (migraine), which is variously interpreted as a vasomotor (sympathetic) disturbance, or neuralgia of the intracranial branch of the trigeminus. Migraine is transmitted by heredity directly, or is an expression of an allied neurosis—hysteria, epilepsy, insanity—and consists, with them, of an underlying state and explosion from exciting cause. It runs in families, and appears in women, in whom it is by far most frequent, especially in connection with menstrual disturbance.

It occurs in paroxysms without distinct periodicity, though sometimes quite regularly with menstruation, sometimes again twice a month, or several times only in the course of the year. It is especially wont to occur in connection with emotional disturbances.

The attack begins usually in the morning, upon awakening after a night of restlessness or heavy sleep, with malaise, *depression, irritability,* and the headache supervenes at once as a dull distress, sometimes diffuse, usually localized in one or the other, more frequently the left, side of the head. The pain is sometimes confined to the region of individual nerves, especially in connection with parietal and supra-orbital branches, and varies in every degree of intensity. *The special senses are hyperæsthetic:* light pains the eyes; scotoma is common; crenellated outlines more rare; noises otherwise unnoticed inflict punishment; odors excite nausea. Disturbance of the stomach assumes such prominence as to have given the common name to the disease, sick-headache. It is not the cause of the headache or neuralgia, but is a coeffect of a common cause. *Vomiting* occurs frequently, with discharge of the contents of the stomach, or, as the stomach is usually empty, of accumulated mucus and regurgitated bile. The face on the affected side is usually flushed, and branches of the temporal artery throb visibly in their tortuous course.

Diagnosis.—Migraine is distinguished from epileptic forebod-

ings by the stomach distress and preservation of consciousness, and from Bright's disease, renal cirrhosis, by the absence of albuminuria.

The *treatment* is usually successful at first, but fails later with the same remedy. Rest in bed, with perfect quiet of mind and body, is the first essential. Every case requires study for the discovery, and if possible removal, of some distinct cause, as anæmia, dyspepsia, irregular habit, insufficient sleep, mental strain, excess in social life, domestic trial, etc. The attack proper is relieved or curtailed by the bromides in large doses, gr. xxx.–xl. in a glass of water, caffeine gr. ij.–iij., guarana gr. xxx., the powder of coca leaves gr. xv., cocaine gr. ss., antipyrin gr. v.–x. Any of these remedies may succeed at first, but with increasing tolerance fail in later attacks. The only real success is accomplished by address to the underlying state. Increase in the general health prolongs the interval and reduces the severity of the attacks. Change of climate often gives relief. Change of occupation may have the same effect. The attacks cease sometimes with the grand climacteric in women and at the corresponding period of life in men. Sometimes they remain in greater or less severity, defiant of all medication, as a life-long evil.

Gastralgia, neuralgia of the stomach, has already been described in connection with disease of the stomach, and neuralgias of the heart, palpitation, angina pectoris, etc., in connection with disease of the heart.

Enteralgia, neuralgia of the intestine, nervous colic, depends upon the same causes as gastralgia. It occurs especially in nervous individuals, and alternates with other forms of neuralgia. It shows itself also in other cases independent of other neuroses or of a neuropathic temperament, as the result of a toxæmia. A typical example of this enteralgia is furnished in lead colic, where the disease is due to the direct effect of lead upon the ganglionic centres. As in gastralgia, the pain may be very severe and may be attended with sinking sensations, vomiting, heart failure, and collapse. Hot applications, including copious injections of hot water, with the administration of anodynes, morphia subcutaneously, relieve the attack. The cause, when rheumatic, is most effectively addressed by salicylic acid in doses of gr. x. every hour or two until the ears ring. The remedy must be administered continuously at longer intervals for a week. Lead poisoning calls for appropriate treatment.

Neuralgia of the Spermatic Nerve occurs more especially in the young, and shows itself in shooting pain which radiates from the testicle along the course of the spermatic cord. It may be also associated with nausea, vomiting, and sinking sensations. The treatment is the same as that of the neuralgias just mentioned.

Neuralgia of the Joints occurs especially in connection with

hysteria, and is sometimes one of the most obstinate manifestations of that disease. It is usually confined to a single joint, the hip or knee, and may show itself with all the signs of acute rheumatism, including at times redness of the skin. It is sometimes attended with deformity and atrophy from disuse. The diagnosis is often difficult, but is assisted by consideration of the age, sex, and history. The hysterical joint occurs in connection with other signs of hysteria. The sensations of pain and distress are out of all proportion to the objective signs, etc.

The *treatment* of neuralgia consists in the discovery and removal, if possible, of the cause. This cause is often, as stated, an infection of the blood, and treatment consists in the neutralization of the products of infection. Thus quinine and arsenic quickly cure the most obstinate cases of malarial neuralgia, and mercury and iodide of potassium cure or control the pains of syphilis. Neuralgias of the stomach and bowels, gastralgia and enteralgia, are usually relieved by salicylic acid or salol; the neuralgic pains of Bright's disease are best controlled by hot baths and remedies which produce sweating—jaborandi, pilocarpine. More permanent effects are obtained by the use of mineral waters, sojourn at watering places, etc. Neuralgias which depend upon alterations of the blood—anæmia, chlorosis, etc.—are treated with some of the various preparations of iron, as mentioned under Chlorosis, etc. The various antipyretics—phenacetin gr. x., antipyrin gr. v., antifebrin gr. v.—give sometimes immediate effects. Counter-irritation, especially in the form of linear cauterization, may control obstinate cases of neuralgia in the neighborhood of the spine. The remedy of most value for general use is *electricity*, which may be used in the form of the induced or constant current. The negative pole is applied usually to the spine in the neighborhood of the origin of the nerve; the positive is stroked gently along the course of the nerve, or is held fixed for five minutes at the seat of pain. Gentle currents which produce only redness of the surface are attended with the best effects.

Atropine (gr. i.–℥ i.) gtt. iij.–v., hyoscyamine gr. $\frac{1}{100}$, are effective anodynes. Sometimes a severe neuralgia is relieved at once by injection into the substance of the nerve, with the subcutaneous needle, of chloroform or ether gtt. v.–x. This procedure proves of most value in cases of sciatica. Morphia should be used only as the last resort in extreme cases. The evils of the opium habit are mostly engendered by resort to morphia in relief of neuralgia.

The treatment of neurosis of the joints is that of the general rather than the local condition, whereby it is often best to ignore the joint affection as much as may be, for concentration of attention upon it often aggravates the malady. Isolation of the patient, or,

better still, occupation of a bed in a hospital ward by the side of cases of real maladies—other than joint diseases, of course—accomplishes more than local treatment. Nevertheless massage, manipulation, hydrotherapy, electricity, salol, are sometimes of value.

NEURITIS.

Neuritis.—Inflammation of nerves, attended by hyperæmia, infiltration, and degeneration. Neuritis may be acute or chronic, fixed or wandering, ascending or descending in the course of the nerve.

It is usually due to trauma, though it may result from extension of inflammation from contiguous structures. Thus an ascending neuritis is sometimes seen to develop in consequence of an infection of the genito-urinary organs. A good example of a descending neuritis is found in connection with changes in the spinal nerves issuing from a cord affected with locomotor ataxia. The neuritis produced by the action of toxines—diphtheria, typhoid fever, etc.—is a process better known in its effects than its lesions. The peculiar infection of the tropics known as beriberi and kakke (Japan) is regarded as a panneuritis. This disease is associated with heart failure, with paræsthesiæ, numbness and burning, and paralysis. Neuritis sometimes follows exposure to cold. This form is known as rheumatic. It occurs also in connection with syphilis, lepra, cancer, and gout. Multiple neuritis is often distinctly caused by alcohol. The pains of neuritis differ from those of neuralgia, in that they are more continuous and are aggravated rather than lessened by pressure. They are also associated with more or less anæsthesia. Muscles in the domain of the affected nerve lose their electric excitability and show later the reaction of degeneration. Trophic changes sometimes develop ; herpes zoster is common. A much more rare trophic change is the perforating ulcer of the foot, *malum perforans pedis*, which develops as a progressive ulcer, uncontrollable in its progress, on the sole of the foot.

Multiple Neuritis distinguishes itself by the affection of a number of nerves, usually consecutively. It results, as stated, chiefly from alcoholism, and is the common cause of alcoholic paralysis. It occurs, however, in connection with exposure to cold, rheumatism, and exhaustion ; sometimes as the result of toxæmia. The musculo-spiral and anterior tibial nerves are usually first affected. The wrist drops, *the feet are extended* to lie on a line with the legs. The disease begins, as a rule, with fever and sensations of numbness and tingling in the fingers and toes, with more or less rheumatic pain. The nerve trunks are sensitive to pressure. The power of extension of the hand is impaired in both arms. The same weakness soon shows itself in the legs. Electric excitability is lost and

the muscles show the reaction of degeneration; reflex action is also lost; the knee jerk disappears early in the history of the disease. Trophic changes, œdema, and joint effusion are common; the sphincters are unaffected. The disease is chronic, and advances, as a rule, more or less continuously for a period of four to six weeks, when it slowly subsides. Complete restitution requires a period of many months. In the alcoholic form of the disease relapses are frequent.

Treatment.—The asepsis of modern surgery prevents many cases of neuritis. Prompt and more persistent treatment of gout and syphilis has the same effect. The pains of acute neuritis may be relieved by the methods used in the treatment of neuralgia. Counter-irritants are of more decided value. Hot applications, dry cups, tincture of iodine, cauterization, vesicants, may be used in individual cases. The preparations of salicylic acid are of especial value in rheumatic, febrile, and alcoholic forms of the disease. Alcohol

Fig. 276.—Multiple (alcoholic) neuritis; palsy of extensors of wrist and flexors of ankle (Gowers).

itself must be put under ban. The body must be built up with quinine, cod-liver oil, tonics, fresh air, and good food; the affected nerves with electricity and strychnia.

SPASM.

Spasm may be of central or peripheric origin. It occurs as more or less continuous (so-called tonic) and as interrupted (so-called clonic) convulsions. Examples of tonic convulsions are furnished in tetanus, tetany, cramp (cholera), contractures (post-hemiplegic, etc.).

Myotony, a peculiar form of contraction, was first described by Thomsen (1876), as experienced in his own person. It is, hence, often known as Thomsen's disease. In this affection the muscle, instead of being relaxed after effort, remains in a state of tonic contraction for some length of time. The disease may even involve the muscles of the tongue. In a curious case recorded by Ballet and Marie the eyes became fixed, and were only changed with difficulty from the direction which they were made to assume.

Torticollis (caput obstipum) is the most common example of

tonic spasm. The muscles usually affected in this condition are the sterno-cleido-mastoid, the splenius, and the trapezius. The head is rotated to one side and the face is turned up. Distinction must be drawn between cases which originate from simple exposure to cold, so-called rheumatic affection of the muscles, and conditions due to diseases of the spinal cord or vertebræ, as caries of the spine. The rheumatic affection may give rise to much pain and distress, but is of short duration. It disappears readily under faradization, hot applications, anodynes, stimulating liniments, etc.

℞ Tincturæ opii, tincturæ aconiti, olei olivæ .....āā p. æ.
M. S. Liniment.

Pain may be relieved by the use of atropia gr. $\frac{1}{100}$, or hyoscya-

Fig. 277.—Spasm of the trapezius (Duchenne). See also page 323.

mine gr. $\frac{1}{100}$, subcutaneously. Cases due to organic disease are exceedingly obstinate, sometimes irremediable. Section and exsection of the nerve afford only temporary relief. Better results may be reached by exsection of a series, as of the first three cervical nerves, after the method suggested by Keen.

Lumbago, which is interpreted as a rheumatism of the muscles of the loins or lumbar region oftener than as a peripheral nerve affection, may be so severe as to demand the injection of morphia gr. $\frac{1}{4}$ deep into the substance of the muscles.

PARALYSIS.

Paralysis (παραλύω, to loosen) may be central or peripheral. It shows itself as impairment or abolition of motion. Partial paralysis is sometimes distinguished as paresis. Paralyzed nerves

degenerate. This degeneration is marked by certain changes in electrical irritability. In the normal *nerve* the application of the negative pole, cathode, produces contraction at the moment of closing, and of the positive pole, anode, at the moment of opening the circuit. Healthy *muscle*, independent of the nerves, cannot be excited to contraction by the induced (faradic) current, but may be excited to slow contraction by the constant (galvanic) current. When the nerves are degenerated the induced current fails to excite contraction when brought to bear either upon the nerves or upon the muscles ; and the constant current will not act upon the nerves, but will nevertheless produce a slow contraction in the muscle so long as the muscle itself has not suffered degeneration. For a certain period muscles supplied by degenerated nerves are more easily excited than muscles supplied by healthy nerves. Contraction occurs earlier and stronger, and the order of contraction is reversed. That is, the positive pole produces the strongest contraction with closing, and the negative with opening, the circuit. This change, which indicates a certain period of degeneration, is known as the *reaction of degeneration*. It is a valuable sign in both diagnosis and prognosis.

Muscles supplied by degenerating nerve fibres are more sensitive also to mechanical irritation. A stroke upon the muscle, or exposure to cold air, excites contraction. Such idio-muscular contraction is seen in the muscles of patients suffering from marasmus from any cause, tuberculosis, carcinoma, etc., and is typically shown in the fibrillar contractions of progressive muscular atrophy.

PARALYSIS OF THE FACIAL NERVE—BELL'S PARALYSIS.

Paralysis of the facial nerve arises in consequence of disease or injury to the nerve at its origin, course, or distribution. The paralysis is central or peripheral. *Central paralysis* occurs in connection with hemiplegia (hæmorrhage, embolus), and is nuclear, supra- and infranuclear, according as the lesion is situated in, above, or below the pons. In supranuclear lesion the nerves about the mouth suffer most, and voluntary are more impaired than emotional movements, while electrical reaction remains normal. In nuclear and infranuclear paralysis all parts of the face are paralyzed and secondary changes set in with reaction of degeneration. Injury in the intracranial course of the nerve is usually inflicted by meningeal exudation and tumors. The condition is recognized by implication of the auditory nerve. Disease of the ear, caries of bone, is the most common cause of damage in the Fallopian canal.

Etiology.—In the great majority of cases the lesion is *peripheral*, and is a form of neuritis, the result of exposure to cold. Paralysis

is especially wont to set in after sitting in a draught, as at an open railroad car window, where the rest of the body is superheated. Syphilis affects the eye (oculo-motor, abducent) much more frequently than the face. Peripheral facial paralysis is sometimes observed in consequence of suppurative parotitis, and is not infrequently produced in the new-born by the pressure of the forceps.

Certain families, certain individuals (neurotic), are predisposed to the disease.

FIG. 278.—Facial paralysis, left side, under attempt at contraction of all the muscles of the face (Putzel).

Paralysis is limited to one side, but is exceptionally bilateral, in consequence more particularly of disease of the pons, sometimes of diphtheria.

Symptoms.—In complete paralysis of the facial nerve one whole side of the face becomes immobile. The muscles hang without expression, so that the affected side looks like a mask. The contrast, which is marked even at rest, becomes more marked with the attempt to express an emotion. The contraction of the sound distorts

the affected side. The eye is open and cannot be perfectly closed. The ball is rolled upward in protection against the light. The patient is unable to lift the eyebrows, corrugate the forehead, move the side of the lips, show the teeth, whistle, or blow. On account of affection of the buccinator, food accumulates between the teeth and cheeks. With lesion at or above the geniculate ganglion one side of the palate is paralyzed; it hangs lower than the other side, and is not lifted in articulation. The uvula deviates (is drawn) toward the sound side. Paralysis of the stapedius is taken advantage of by the tensor tympani to render the hearing more acute. In pure peripheral paralysis affection of the hearing is rare and the palate shows no deviation. Sensations of pain, sometimes experienced, are attributed to implication of sensitive fibres which run back in the course of the chorda tympani from the trigeminus.

The important point in *diagnosis* is the differentiation of central

Fig. 279.—Facial paralysis, patient æt. 65; showing loss of tone in inelastic skin. Figure on right represents attempt to close both eyes (Gowers).

from peripheral lesion. Central lesion occurs, as stated, in connection with hemiplegia of the same or opposite side, and the paralysis of the face is only partial. The patient can open and close the eyes. In central lesion reflex and associated movements remain and the muscles respond to the faradic current at any period. Peripheral lesion is more complete. The patient cannot open and close the eyes, and electrical irritability is diminished or lost. In peripheral affection the lesion is assumed to be intracranial when the auditory or other cerebral nerves are affected, or when the opposite side of the body is paralyzed. Paralysis of the palate speaks for lesion at or above the geniculate ganglion. The lesion is assumed to be in the Fallopian canal when it is found in association with otitis media, caries of the petrous portion of the temporal bone, and affection of the hearing. The lesion is superficial in the absence of these signs.

The *prognosis* depends upon the cause. In the superficial

(rheumatic), which is the most frequent form of the disease, the prognosis is good, and is chiefly determined by the electrical reaction. Any response to the induced current is a favorable indication. Such cases terminate with complete restoration in the course of a few weeks. In the absence of all response to the induced current, and of signs of the reaction of degeneration with the constant current, the course is more chronic; recovery requires a period of several months. A few cases never recover.

The *treatment* is the application of electricity in the form of the constant current, the negative pole behind the jaw under the ear, the positive stroked gently along the course of the facial muscles. The session, daily or tri-weekly, should not continue longer than five minutes. All other treatment is superfluous. The physician should never despair of relief so long as there is any kind of reaction to electricity. In the experience of the author, a young lady deformed by attack in childhood had the deformity greatly relieved by galvanization, though fourteen years had elapsed without any treatment at all.

MENINGITIS, SIMPLE CEREBRAL.

Pachymeningitis (παχύς, thick); leptomeningitis (λεπτός, thin); simple, as distinguished from cerebro-spinal and tubercular, meningitis; meningitis of the convexity, as distinguished from basilar meningitis.—Meningitis, in general, was first recognized as an affection separate from disease of the brain by Morgagni (1760). Epidemic cerebro-spinal meningitis first attracted the attention of Vieusseux, of Geneva (1805), and of Strong, North, Fish, Hale, Miner, and Williams, of our own country (1806–1814), and had been at that early period easily differentiated from affections limited to the membranes of the brain. Parent-Duchatelet and Martinet (1821) first distinguished inflammation of the dura and pia mater, and Guérin and Guersant (1836–1839) first distinctly recognized and set apart the tubercular, granular, or basilar form of the disease. The first clear descriptions of the exclusively "simple" meningitis, from a pathological standpoint, are to be found in the works of Cruveilhier (1830); and from a clinical standpoint, in those of Andral (1834) and of Rilliet and Barthez (1843). The recognition of the fact that simple meningitis is always a secondary affection is the result of the more accurate post-mortem observations of the last ten years, in the light of the recent investigations concerning infections, and the contributions from otology.

Pachymeningitis, inflammation of the dura mater, presents itself in two forms, external and internal, purulent and hæmorrhagic, representing entirely different disease processes. The first of these

forms alone deserves the title or termination of the name, as it alone shows the signs and lesions of an inflammation, pachymeningitis externa, the hæmorrhagic form, being really the result of a degeneration rather than an inflammation; but in the absence of definite knowledge regarding the genesis of this disease, the two forms may be best studied together.

Pachymeningitis Externa.—Accidents or injuries which directly expose the dura, or effect its separation from the bones of the skull, with consequent extravasation of blood, whereby is implied, at least, a "hidden crevice" or some communication of the dura with the air, lead at once to inflammation of the outer lamella, which may extend to involve all the rest of the membranes of the brain. Carious processes of the ear constitute an even more frequent cause of this condition. A mere microscopic breach in the thin wall of bone that forms the upper covering of the tympanic cavity will bring pus from the tympanum to the dura. So, also, caries of the ethmoid bone (ozæna), or other bones of the cranium (syphilis, carbuncle), may excite this form of meningitis; and, even without caries, purulent inflammation of the mucosæ in the ethmoid and frontal sinuses may extend to the dura through natural openings of communicating vessels. This complication has been noticed more especially in erysipelas after "mixed infection," whose nature it is to spread. As purulent pachymeningitis rarely remains confined to the dura, but extends, as a rule, to involve the pia mater, the symptoms, pathology, and treatment of this condition will be further discussed with leptomeningitis.

Pachymeningitis Interna.—The disease of the dura which merits most consideration, from its frequency, limitation, and recognizability in life, is that affection of the inner layer characterized by the extravasation of blood and subsequent development of an adventitious membrane, commonly known as hæmatoma duræ matris, and technically described as pachymeningitis interna hæmorrhagica. With these characteristics it is plain that internal pachymeningitis does not supply the requisite conditions nor rise to the nosological dignity of an inflammation in the modern sense of the term. It develops oftenest independently of all infection, and should properly be discussed as a subvariety of cerebral hæmorrhage.

The *pathology* of this affection remains as yet obscure. The early anatomists and clinicians were fain content with descriptions of the condition, without venturing to express opinions concerning the nature of the disease. It was commonly held and taught that the disease consisted in the extravasation of blood, and the only question discussed regarded its situation. Thus Abercrombie and Andral (1807) maintained that the blood was effused between the

dura and the parietal layer of the arachnoid, so-called; while Houssard (1817) located the extravasation in what was then, and for the sake of convenience is still, known as the cavity of the arachnoid. The hæmorrhagic nature of the affection was nearly lost sight of when Bayle (1843) considered the hæmatoma as an inflammatory product of the dura, but was again restored by Durand-Fardel (1854), who believed in the development and organization of a flat blood clot. Heschl (1855) regarded the membrane as a highly vascular connective tissue, a view which Virchow, with his predilections for cellular pathology, elaborated into a hæmorrhagic inflammation of the dura as the first process, and a subsequent infiltration of the blood as the second. The authority of these pioneers carried these views with almost undisputed conviction up to our own times, when the studies concerning the nature and processes of inflammation and infection naturally diverted attention to the condition of the blood and its vessels as prime factors in the production of the disease.

That hæmorrhagic pachymeningitis is not the expression of an ordinary inflammation is shown by the fact that no amount of irritation of the dura will produce it. Injections of ordinary irritants into and beneath the membranes of the brain of lower animals may be followed by purulent, but never by hæmorrhagic, pachymeningitis. On the other hand, the injection of blood with all its constituents sufficed, in the experiments of Sperling, to produce the typical signs and lesions of the disease. The rôle of the fibrin in these cases is evidenced by the fact that a membrane was not developed after injections of defibrinated blood.

Internal pachymeningitis consists, then, in the extravasation of blood, the formation of a blood clot which, when the effusion is not too great or rapid, is flattened by pressure, to become subsequently organized into a membrane. In the first stage of the disease process the thin layer of coagulated blood soon begins to show, in the separation of its fibrin, a meshwork which contains multitudinous blood corpuscles. At this time there is no apparent connection with the dura, whose epithelium remains intact. In the consolidation which continues, the clot assumes the appearance and density of a membrane, which now in reality develops from the transformation of white blood corpuscles into spindle-shaped connective-tissue cells, whence the synonym pachymeningitis fibrinosa. The red corpuscles now gradually lose their coloring matter, which collects in spots on the surface and in the texture of the membrane (pachymeningitis pigmentosa), lose their regular contours, and finally become transformed into masses of protoplasm. Young vessels now connect the dura with the membrane, which becomes gradually more dense, thick, and adherent. In the meantime new layers of blood may be

effused into the membrane already in process of formation, which consists thus of superimposed lamellæ—Virchow has seen as many as twenty—for a time separable from each other. The effusion takes place chiefly upon the convexity of the brain, limited, in fifty-four of sixty-five cases collected by Kremiansky, quite precisely to the region covered by the parietal bones. It is rather more frequently bilateral than unilateral, being confined to one hemisphere in but forty-four per cent of cases.

The source of the hæmorrhage still remains a matter of dispute and doubt. Kremiansky thought it came from the middle meningeal artery, an origin which comports well with the situation of the clot; but Huguenin declares that he has never seen this vessel affected in any of his observations. This author is inclined to find the lesion in the veins which run from the cortex to the longitudinal sinus along the falx cerebri ; and Pacchionian vessels have likewise been accused, but all alike without as yet satisfactory anatomical proof.

The chief danger of these effusions is pressure upon the brain, which shows itself in proportion to the amount of the extravasation. Huguenin has seen a hemisphere flattened by a large unilateral hæmatoma, which may be as large as a hen's egg—Eichhorst mentions effusions of five hundred grammes—and in some cases a lateral ventricle has been reduced by pressure to half its size. The great evil of pressure is obviated in many cases by the latitude allowed by atrophy of the brain substance, a condition rather, as a rule, coincident with hæmatoma of the dura. In fact, the greatest contingent of cases is found in connection with paralytic dementia, and cases independent of some degree of atrophy are comparatively rare.

When, from any cause, a real inflammation is engrafted upon this hæmorrhagic degeneration, serum or pus may be found in connection with the blood which forms the hæmatoma. As curiosities in this direction, Virchow describes a hydrocephalus externus pachymeningiticus, and Weber saw, in a lamellated hæmatoma, blood in one cavity and yellow-green pus in another.

Various changes in the skull membranes and brain have been observed in connection with pachymeningitis, but none so frequently as to belong to it of necessity. Thus the bones have been found thickened or thinned, with an agglutinated dura at times, the pia anæmic, hyperæmic, and swollen, or cloudy and opaque, separable or adherent to the dura, etc. The frequency with which general atheroma of the cerebral vessels is seen, with thromboses, softenings, apoplexies, scleroses, etc., of the brain, bespeaks the intimate relation of these processes to the development of the disease, in connection more especially with general paralysis, alcoholism, insanity, senile atrophy, etc.

Pachymeningitis is a much more frequent affection than is commonly believed. Savage records its presence in three per cent of the autopsies made at the asylum at Bethlehem; and when it is remembered that there are more cases of dementia and insanity, not to mention alcoholism, out of than in asylums, it is seen that this percentage is far too low. It is safe to say that most of the cases remain undiagnosticated during life; and death, when it occurs, though perhaps caused by this affection, is ascribed to the disease in the course of which this accident develops. All authors agree in noting three-fourths of all the cases in the male sex, a proportion which corresponds to the relation of the sexes to the affections which produce the disease. For the same reason hæmorrhagic pachymeningitis is a disease of advanced life. Exceptional cases at early periods of life—six months to eight years—have been recorded by Weber, Moses, Steffen, and others, mostly in connection with the venous stases from the strain of asthma, pertussis, etc., or the impoverished nutrition of blood vessels from scurvy, leukæmia, and more especially pernicious anæmia; and cases have been more abundantly reported during adolescence and maturity in connection with tuberculosis, empyema, valvular lesions of the heart, the various forms of Bright's disease, the various infections (variola, scarlatina, acute articular rheumatism, and typhoid fever), and more especially local injuries of the dura (seventeen of seventy-four cases described by Schneider); but, aside from these accidents, pachymeningitis remains a disease of age. The largest number of cases, twenty-two per cent, in the collection of Huguenin, occurred between the ages of seventy and eighty.

Symptomatology.—Internal pachymeningitis exists at times without a symptom to mark its presence. Moses reports such a case in a child, aged seven months, who died of catarrhal pneumonia. At the autopsy there was found a pachymeningitic cyst which covered the anterior half of the right hemisphere, though no sign of brain disease had ever been manifest in life. Slight extravasations often show no sign because of absence of pressure, or, if slowly effused, because of tolerance, which the brain acquires often in astonishing degree. In other cases the accident is overshadowed by symptoms pertaining to the original disease. These are, however, all exceptional cases. As a rule the disease may be diagnosticated during life by signs which are not so valuable in themselves as in their etiological relations.

In the majority of cases the disease announces itself suddenly and violently. The patient is stricken with *apoplexy*. The hæmorrhage may be so great as to cause death by compression of the brain within forty-eight hours. The nature of the disease, or, more strictly,

the localization of the hæmorrhage, is, as a rule, in such cases impossible to determine. The first attack is not, however, usually fatal. In exceptional cases the patient may recover fully, but as a rule a train of symptoms ensue which more or less distinctly characterize the disease. These symptoms vary greatly in individual cases, vary according to the locality and extent of the effusion, as well as according to the nature of the original disease; but they do not differ in essential characters from the symptoms of meningitis from any cause. *Headache, stupor,* which may at any time deepen to *coma; monoplegias, hemiplegias,* or, in the irritant stage, *unilateral twitchings and convulsions,* limited at times to one extremity, or confined to the area of distribution of the facial nerve; *aphasia,* when the region of the language centre is compressed—these symptoms, together with an irregular or retarded pulse, vomiting, and more especially contracted or dilated pupils irresponsive to light, with little or no disturbance of general sensation, make up a group which, as a rule, distinguishes the disease.

But, as already intimated, it is not so much the symptomatology of the affection as its *etiological relations* which strictly define the disease. The general signs of meningitis refer especially to hæmatoma only when they occur in the course of general paralysis, chronic psychoses, alcoholism, chronic Bright's disease, pernicious anæmia, traumata, the affections mentioned in the discussion of the etiology of the disease.

Another distinguishing, but by no means so distinctive, feature to indicate the nature of the affection is the *recurrence* of the symptoms. Total or partial recovery from all the general manifestations of meningitis is followed in pachymeningitis, as a rule, by repeated attacks; and though the special symptoms may show great variety in relapses or recurrent attacks, the general character of the new signs is definitely sustained.

The *diagnosis* of pachymeningitis is based upon these two cardinal points: the existence of an underlying condition or causative disease, and the more or less rapid recurrence of the attacks Cases are further characterized by suddenness of onset and rapidity of recovery. The author had under observation an individual affected with chronic alcoholism, who was suddenly stricken with apoplexy on the street. The patient was carried comatose to the hospital. The coma subsided in the course of a few hours, to leave a complete right-sided hemiplegia, which entirely disappeared in three days, leaving the individual in better physical and mental condition than for ten years. Many of the cases of so-called "serous" apoplexy characterized by sudden onset, and more especially by speedy recovery, are really cases of pachymeningitis.

The *predominance of symptoms indicating cortical lesion* is another feature of diagnostic importance. Thus localized convulsions and contractions, monoplegias, contracted pupils, following an apoplectic attack in an individual predisposed to the disease by the factors already emphasized, point almost certainly to pachymeningitis.

The age and sex of the patient must not be overlooked.

Basilar meningitis is differentiated by the youth of the patient, the family history, the presence of tuberculosis elsewhere, by its long prodromes, its insidious approach, its general and special hyperæsthesia, opisthotonos, boat-shaped abdomen, etc.

Cerebro spinal meningitis prefers winter, soldiers, and children, occurs at times in endemic proportions, shows opisthotonos, herpes, and sometimes petechiæ, extreme hyperæsthesia, spinal lesions, and does not recur.

The *prognosis* is always grave. Recovery without recurrence is possible, but not probable. The patient succumbs, as a rule, in a subsequent attack, if he does not fall a victim in the meantime to the original disease. The immediate prognosis is best established, as after any cerebral hæmorrhage, by frequent observations of the temperature, whereby the degree of the rise after the initial depression incident to the shock would receive proper interpretation. A sudden or gradual elevation to a high grade (105°) at any time thereafter, independent of the original disease, is a sign of most ominous significance.

Treatment.—The treatment of pachymeningitis does not differ materially from that of any form of meningitis or cerebral hæmorrhage. The application of an ice bag to the head, the local abstraction of blood by leeches or cups behind the ears or over the temples, "derivation" by purgatives (calomel, senna, croton oil), constitute the routine plan, which is sanctioned more by time and use than by benefit based upon demonstrable proof. Tranquillity of surroundings, with all the measures which make up a more or less perfect hygiene, are the most effective agents in prophylaxis in the chronic psychoses; while abstention from alcohol addresses the "causa indicationis" in cases dependent upon its abuse. Bright's disease, heart disease, pernicious anæmia, etc.—in short, the underlying condition calls for appropriate treatment, and paralyses, convulsive manifestations, persistent headaches, whatever symptoms may be left, are to be met with symptomatic treatment.

PACHYMENINGITIS CERVICALIS HYPERTROPHICA is a peculiar subvariety of meningitis, produced by great thickening of the meninges in the cervical cord, and marked by severe pains in the back of the neck and both arms, with atrophy of the muscles of the neck and flexors of the hands, and final spastic paraparesis.

LEPTOMENINGITIS.

It is possible, as already stated, that a real inflammation may limit itself to the dura mater alone, but such a distinct circumscription is very rare. Inflammation of the dura extends, as a rule, to involve the pia mater. The same qualification applies to the pia mater, though a strict limitation to the pia mater is more frequently observed. The subsequent remarks apply more especially to inflammation of the pia mater, with which the dura is, or may be, secondarily affected in greater or less degree. It is taken for granted that cerebro-spinal meningitis and tubercular meningitis, diseases due to special causes, are not included under the title leptomeningitis, which embraces all other kinds of simple meningitis of known or unknown cause.

Leptomeningitis is always a secondary affection. The cases considered idiopathic become, under closer observation, so much fewer every year that it is more safe to appeal to unknown primary affections than to subscribe to the possibility of a spontaneous or idiopathic meningitis of any kind. A thorough conviction in this regard will alone lead to the searching investigation necessary in many cases to discover the original disease.

Affections of the ear constitute by far the most fruitful cause of leptomeningitis. Of these affections, chronic suppurative inflammations of the tympanic cavity, which constitute over twenty per cent of all diseases of the ear, most frequently lead to meningitis through caries of the osseous roof of the tympanum. The roof of the tympanum is composed of an excessively thin plate of bone, which is indeed at times congenitally defective, so that the way lies open to invasion of the cranial contents.

A more or less open avenue is also offered in the course of, or along the sheaths of, the facial and auditory nerves and the vessels which penetrate the petrosal fissure. Communication by caries may be also directly established between the cavity of the cranium and the mastoid cells; while indirect involvement of the meninges may follow phlebitis and thrombosis of the cavernous, transverse, and superior petrosal sinuses, as revealed by dilatation of the veins and local œdema in the region of the mastoid process. Tuberculosis plays a prominent rôle as a special cause in the production of all these processes, while syphilis furnishes a small contingent of cases through caries of the upper meatus of the nose.

Every meningitis whose cause is not obvious should excite suspicion of ear disease, which may reveal itself to the sense of smell in an offensive odor, before or in the absence of visible discharge. So, also, every case of otorrhœa should excite the fear of possible meningitis.

Trauma or injury to the cranial bones constitutes a not infrequent cause of simple meningitis. Where compound fracture has occurred, or direct penetration has been effected, the sequence is sufficiently simple. In other cases the meninges, though not directly exposed, become affected through phlebitis, thrombosis, or suppurations occurring in the patulous veins of the diploë, whereby is implied, as previously intimated, some hidden crevice or pre-existent communication with the air. A far more infrequent involvement of the meninges occurs at times, when an abscess in the interior of the brain reaches its periphery, or bursts into a lateral ventricle to come in contact with inflections of the pia mater at the base of the brain. So-called brain "softenings," which consist simply of brain and tissue débris, and simple hyperæmias, the so-called "congestions" of the brain, including sunstroke, could not, with our present knowledge of the nature of infections, produce a leptomeningitis.

Next in frequency to the direct invasion of the meninges from disease of the ear are the metastatic processes from distant depots of infection. Any one of the acute infectious diseases may be thus attended or followed by meningitis, which is justly regarded as the most serious complication which can occur—which, indeed, imparts a sudden gravity to an otherwise mild case of disease. Of all the acute infections, pneumonia is the disease in which this complication most frequently occurs. The intimate relations of tuberculosis of the lung and brain in the frequent sequence of basilar meningitis upon tuberculosis pulmonum, prepare us in a measure for the frequent supervention of meningitis in the course of croupous pneumonia. The same connection or relation has been observed also in cerebro-spinal meningitis, and bacteriologists have pointed out the striking resemblance of the micro-organisms found in these two affections. Pyæmia and septicæmia may be said to vie with pneumonia in the production of metastatic meningitis, while endocarditis, empyema, acute articular rheumatism, the exanthematous diseases —more especially variola and scarlet fever (aside from ear disease), and very rarely typhoid fever—diseases mentioned in the order of frequency, furnish exceptional cases. As curiosities, equally illustrative, however, of the nature of the process, may be mentioned the cases of meningitis which have followed such trivial infections as vaccinia and mumps.

The *morbid anatomy* and *symptomatology* of this form of meningitis do not differ, except in the preference of the convexity to the base in the case of inflammation from metastatic and traumatic causes, from the cerebral signs and lesions of cerebro-spinal meningitis, which have been fully described elsewhere.

The *diagnosis* of meningitis in connection with disease of the

ear, or trauma of the bones of the cranium, is very easy, as a rule, but the diagnosis of metastatic meningitis is often very difficult. High fever and blood poisoning show symptoms which so closely simulate the signs of meningitis as to render an absolute diagnosis impossible, at least for a time. The persistence of these signs after subsidence of hyperpyrexia sometimes declares the disease. Tuberculosis, pyæmia, scarlatina, variola, erysipelas, and typhoid fever are the affections which oftenest create doubts as to the diagnosis. But if close scrutiny be made of the etiological factors, and close attention be paid to the course of the disease, the diagnosis, as a rule, soon becomes clear. In distinction from tuberculosis and typhoid fever, it may be said that meningitis develops quickly, almost suddenly, with violent pain in the head, active delirium, and often with stiffness of the muscles of the neck or retraction of the head.

Tuberculosis and typhoid fever show also typical temperature curves, with lung symptoms in tuberculosis, and abdominal symptoms in typhoid fever. In scarlatina, variola, and erysipelas it is rather a question of detecting a complication, as each disease shows characteristic eruptions upon the surface. Here, too, the persistence of cerebral signs after subsidence of the high temperature is of value. Septic and pyæmic diseases follow wounds, are attended with chills, show joint affections and internal metastases. Ulcerative endocarditis, a septic process, has the same history. Uræmia is recognized by the dropsy, the condition of the urine, and, so far as the nervous symptoms are concerned, by the predominance of convulsions.

Cerebro-spinal meningitis is differentiated by the more prominent disturbances of sensation, by herpes, and by the occurrence of other cases. Basilar meningitis occurs more especially in children affected with tuberculosis elsewhere, or who come of tuberculous stock. It has long prodromata and a longer duration. Its symptoms are less acute and intense. It more frequently implicates the membranes of the spinal cord. Pachymeningitis is a disease of age. It occurs in drunkards, dementia paralytica, chronic insanity, etc. It shows a more fluctuating course. It must be repeated again and again that the various forms of meningitis are to be separated and recognized more by the etiological relations of the disease than by any difference in symptomatology.

The *prognosis* is far more grave than that of cerebro-spinal, but not so absolutely fatal as that of basilar, meningitis. The great majority of cases terminate fatally, in coma or convulsions, in the course of from two to ten days.

The *treatment* of leptomeningitis does not differ in any way from that of any other form of meningitis; what little may be

accomplished in the relief of symptoms has been mentioned under the title Cerebro-spinal Meningitis. The physician who is thoroughly indoctrinated as to the dangers of disease of the ear, and who is thoroughly familiar with the recent researches regarding the nature of infection, will prevent many cases of meningitis by timely treatment of the ear and by scrupulous antisepsis in all wounds of the skull.

CHAPTER XII.

DISEASES OF THE SPINAL CORD.

MYELITIS.

Myelitis (*μυελός*, marrow).—Inflammation of the spinal cord, attended by paraplegia with anæsthesia, interference with the action of the bladder and bowels in the chronic form, and degeneration of the affected nerve cells, fibres, and muscles. The disease is distinguished, according to its distribution, as central, transverse, peripheral, focal, and disseminate. Central myelitis, which affects chiefly the gray matter, is known as poliomyelitis (*πολιός*, gray). Transverse myelitis affects a whole section ; peripheral myelitis, the outer layer ; focal is a local depot ; disseminate are scattered depots throughout the cord.

History.—Inflammation of the cord was separated from that of its membranes at the beginning of the present century. It was at this time that the term myelitis was appropriately substituted for spinitis. The first extensive description was furnished by D'Angers (1821). Hereupon ensued the discussion as to whether or not the softening observed in the cord was of an inflammatory nature. Virchow decided this question affirmatively. The modern studies of the histology of the cord and of its physiology, as determined by experiments, furnish the data for the localizations effected in recent times.

The *etiology* of myelitis remains obscure. Individual cases certainly ensue upon exposure to cold, but experiments in this direction furnish contradictory results. The same statement may be made regarding the action of other causes—fatigue ; excesses, especially sexual excesses ; suppression of menses or other discharges, as from hæmorrhoids, fistula ; sweating, as of the feet.

The development of cases under the influence of mental emotions —anger, fright, etc.—is an assumption difficult of demonstration. The tendency of the present time is to ascribe all cases to the action of some toxic agent developed in the course of an infection and possibly latent for some length of time. The affection of the cord which occurs in cerebro-spinal meningitis, and which may occur in septic

(puerperal) affections, small-pox, typhoid fever, etc., lends support to this view. Certain chronic cases are attributed to the influence of alcohol and syphilis. The disease has certainly followed after hæmorrhage in the cord, and has occurred in consequence of all kinds of injuries; hence myelitis is more common in males, and in the younger—that is, the more exposed—periods of life. The myelitis of childhood is the affection, localized in the anterior cornua, which constitutes infantile paralysis.

Morbid Anatomy.—Myelitis is divided into stages of hyperæmia, fatty degeneration, and cicatrization. In the stage of hyperæmia the cord is swollen, reddened, and softened; the vessels are surrounded with corpuscles and a gelatinous exudation. Nuclei multiply in the cells of the neuroglia. The axis cylinder in the nerve fibres is swollen, beaded, and granular. Ganglion cells are enlarged, apparently softened, separated, and robbed of their nerve fibres. In the second stage fatty degeneration brings about the yellow and white softening visible to the naked eye. A granulo-fatty degeneration affects the vessels of the connective tissue and nerve elements in every direction. In the third stage the cord begins to shrink, its consistence increases, and fat accumulates in its tissues and cavities. The connective tissue proliferates, shows abundant spider cells and corpora amylacea.

Symptoms.—The mode of onset is various. Sometimes symptoms of *weakness* set in at once, or the weakness may be preceded by *pains or paræsthesiæ* for several days. Convulsive movements are not so common. After the first feeling of weakness *paralysis* develops rapidly; the patient soon finds himself unable to walk or stand; rest does not relieve him. Control of the legs is lost, and the patient is put to bed, sometimes in the course of a few hours, paralyzed in his lower extremities. The disease sometimes sets in in the night, so that the patient, who goes to bed apparently well, is unable to get up in the morning. There is also *loss of sensation;* it is, however, not so complete and does not show itself so soon. The *reflexes may be increased or diminished,* according as the seat of the disease interrupts the course of the nerve fibres or breaks up the centre itself. The bladder is affected at first with paralysis of the detrusor, later of the sphincter. There is, therefore, first *retention and afterward incontinence* from overflow. The bowels are affected in the same way. There is at first obstruction, but later paralysis of the rectum. Trophic changes assume prominence. It is almost impossible to avoid the production of *bed sores* of gangrenous character. The slightest pressure causes destructive change, which shows itself usually first in the formation of blebs or bullæ with bloody contents. The blister breaks to leave a slough; some-

times the slough forms without pressure. The same trophic changes favor the development of cystitis from retention. Ulcers may form in the bladder, or cellulitis may develop in the perineum or lower abdomen. Myelitis usually begins below and extends upward, progressively or interruptedly. More rarely it begins above in the cervical or dorsal region and descends to the lumbar region.

The onset of the disease is usually attended with elevation of *temperature* to 102° to 104°. The temperature then subsides to the normal, and usually falls below normal in the paralyzed members. Complications, cystitis, septicæmia from bed sores, marasmus, may subsequently develop fever.

Variation from these symptoms is shown in the more diffuse or disseminated *forms* of the disease. Thus a diffused myelitis is distinguished by the rapidity of its spread and the intensity of its symptoms. The disease may seem to show itself in both extremities simultaneously. Trophic disturbance is also more extensive, and death may ensue in the course of a few days. In disseminated myelitis symptoms develop from different centres ; individual muscles or groups of muscles may be affected in one arm and the leg of the same or opposite side. *Irregular distribution should always excite suspicion of syphilitic origin.*

The *prognosis* must be made with caution. Cases which progress rapidly often terminate fatally by involvement of the respiratory centre. As a rule the disease comes to a stand in the course of a week, and the patient recovers with more or less paralysis, which may or may not yield to subsequent treatment. Any neglect in the management of a case may be attended by cystitis or sepsis.

Treatment.—During the acute stage the inflammation is best treated by application of cold, in the form of ice bags, along the spine. Absolute rest, with attention to the secretions, is a *sine qua non.* The salicylates may be given at the start.

Chronic Myelitis differs from the acute only in the more protracted onset and development of the symptoms. Like the acute, it may be localized or diffused. The disease rests largely on a clinical basis, and is hence often confounded with the degenerations or scleroses. The transverse myelitis, where the thickness of the cord is involved at a definite region, presents the most typical form. The disease occurs more frequently in adolescence and maturity ; is unknown in infancy, and is very rare in age.

Etiology.—With the exception of the cases that may be accounted for by a direct injury, or exposure to cold, especially during fatigue or after over-exertion, the etiology of the disease is obscure. From the fact that alcohol produces a peculiar affection of the peripheral nerves, which affects nerve tissue as in myelitis, certain cases

may be attributed to this cause. Gout is invoked as a cause in the old country. Syphilis has more to support it.

Morbid Anatomy.—The cord may present no visible change to inspection, though some difference in color and consistence is often observed at the affected regions. The color becomes more gray or yellow and the consistence more hard. Changes are distinctly manifest under the microscope. There is alteration of the neuroglia, which becomes amorphous and fibrillated. Nerve fibres waste, the axis cylinder is beaded and narrowed, and the myeline takes on a deeper stain. The blood vessels are varicose; granules accumulate with corpora amylacea. Nerve fibres, cells, and ganglionic masses waste and disappear.

The *symptoms* set in very slowly, but vary little, notwithstanding the different localization of the disease. The affection is usually announced by disturbance of sensation. Various *parœsthesiæ* come and go; there are numbness and formication; the legs go to sleep; a *girdle sensation* is felt at the level of the lesion. Disturbance in the *motor function* is soon established. The slightest exertion produces fatigue; the legs feel weak and heavy; *the bladder and bowels are early affected;* there is constipation, and the action of the bladder is slow. *Impotence* is soon established. Except in the cases where the centres are affected in the cord, *the reflexes are increased.* As the disease progresses, evidences of irritation—twitchings and contractions—disappear, and paralysis advances continuously. Muscles waste; there is paraplegia. Two features distinguish the disease: first, the slow onset and gradual development, and, second, the predominance of motor signs; the motor system is affected so much more than the sensory. In both cases the direction is toward destruction. *The evidence of weakness exceeds that of irritation.* The anomalies of sensation are in the direction of *anœsthesia.* The disease lasts for years, and terminates life usually by complications, especially by decubitus and cystitis. Recovery is possible, but exceptional; hence the *prognosis* is bad.

Treatment.—With the exception of the few cases which may be due to syphilis, there is no radical address in therapy. Antisyphilitic treatment, if pushed too far, aggravates the disease. Iodide of mercury, in minute doses, gr. $\frac{1}{32}$–$\frac{1}{24}$, is the best form. Arsenic is often an admirable tonic. Phosphorus, silver, strychnia, are remedies that may be tried, with but little hope of benefit. More is to be accomplished by hygiene. Warm baths are of value always. Hot peat and mud baths sometimes do good. Counter-irritation, as by stripes with the actual cautery, on each side of the spine, at the seat of the disease, sometimes produces remarkable results. The strokes may be repeated at intervals. Absolute rest is of great advantage at

first, but, maintained too long, favors degenerative change. Galvanism, with short sessions and gentle currents, may arrest the advance of the disease. Faradization may support the muscles for a time. Constant attention must be paid to the bladder and the bowels, and especially to the prevention of bed sores.

LOCOMOTOR ATAXIA.

Locomotor ataxia (*α*, without, *τάξις*, order).—The most frequent and one of the most grave affections of the spinal cord, caused by sclerosis of its posterior columns; characterized by peculiar pains and paræsthesiæ, diminution and loss of the reflexes, disturbance of vision, impotence, inco-ordination of muscles, especially of the lower extremities, and very slowly progressive paralysis.

History.—The term *tabes dorsalis*, wasting of the back, was used by Hippocrates to express certain symptoms attributed to venereal excess, and was limited to this tabes by Romberg (1851), who first distinctly isolated the affection with a classical description in his text book on nervous diseases. Duchenne (1858) named the disease progressive locomotor ataxia. The main clinical symptom, the lack of co-ordination of muscles with retention of voluntary power, was actually first recognized and differentiated from ordinary paralysis or paraplegia by the English physiologist, Todd (1847), who is the real pioneer in this disease. From the seat and character of its lesion it has been named posterior spinal sclerosis. Though Todd had, from the nature of its symptoms, located the disease in the posterior columns of the spinal cord, it was reserved for Rokitansky (1856) to demonstrate and define the lesion as a chronic, diffuse inflammatory process, which converted the portion of the cord affected into a mass of indurated connective tissue. During the following decade French observers, more especially Charcot, Vulpian, Luys, connected the various complex symptoms with the functions of the cord, and Friedreich separated the hereditary form. A most important contribution was made by Westphal (1878) with the discovery of an early and almost pathognomonic symptom in the loss or absence of the knee jerk. Charcot and Raynaud observed the various crises, gastric, laryngeal, and nephritic crises, alterations of bone, etc.

Etiology.—The disease occurs more frequently in males than females, in the proportion of ten to one, and ranges close about the middle period of life. One-half of the cases occur between thirty and forty, one-fourth between forty and fifty, and less than one-fourth between twenty and thirty; it begins but rarely after fifty, and still more rarely under twenty. Any influence of heredity can be traced only very exceptionally—in fact, in but ten per cent of cases.

Syphilis is the overshadowing cause. Statistics of different authors vary as to the frequency of this cause. Fournier puts it as high as 75 per cent. The disease usually occurs in the remoter course of syphilis, and is rare in the early history of the disease. It may follow any of the acute infections, especially diphtheria, and has been attributed to excesses, especially sexual excess, and, with all obscure maladies, in the absence of other cause, to taking cold.

Morbid Anatomy.—The disease is distinguished by sclerosis and atrophy of the posterior columns of the spinal cord, which assume a grayish-yellow color, and show the granulo-fatty changes, with hyperplasia of the connective tissue, characteristic of this degeneration. The dorsal and lumbar portions of the cord are most affected. At these portions the membranes are usually found adherent. In the cervical region the degeneration is usually found limited to the columns of Goll. In the dorsal region it affects all parts of the posterior columns, while in the lumbar region the anterior portion of the posterior columns remains usually unaffected. The degenerative process generally stops at the level of the striæ acousticæ. Certain cerebral nerves, the trunk of the optic, the nerves which innervate the ocular muscles, especially the oculo-motor, are picked upon by preference. Both halves of the cord suffer alike; the process is always symmetrical, and is usually strictly so. The degeneration of nerve tissue precedes the hyperplasia of the connective tissue. The process is a pure degeneration and is in no sense an inflammation.

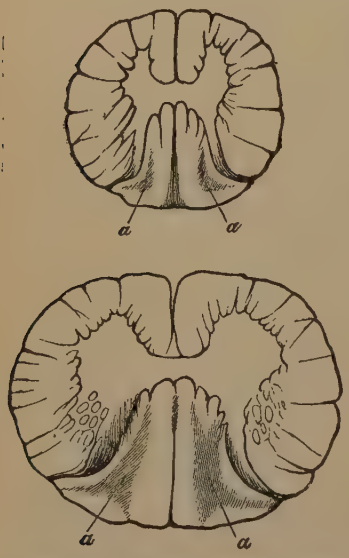


FIG. 280.—Beginning sclerotic patches, *a*,*a*, in the posterior columns of the cord.

Symptoms.—The symptoms of locomotor ataxia fall naturally into three groups, *the sensory, atactic, and paralytic*, which present themselves in predominance in succeeding stages of the disease. But these symptoms show no necessary sequence; they may occur at any period of the disease. Individual cases begin with atactic symptoms, and sensory phenomena show themselves throughout the whole history of the disease. Paralyses are commonly limited to the last stage. Locomotor ataxia is usually announced by peculiar *pains*, which are *distinguished by their suddenness of occurrence, intensity, and shortness of duration.* Lancinating pains, like lightning

strokes, shoot through the body, the pelvis, and lower extremities, more rarely the upper extremities. The attacks of pain usually occur in paroxysms of one or several days' duration, with subsequent intervals of days, weeks, or months. Sometimes the pains are more or less constant; in very rare cases they may be entirely absent. An equally early symptom is some *anomaly of sensation*, especially in the lower extremities. The anomaly may be appreciated first as a diminished sensitiveness to the faradic current. The surface may become almost insensitive to severe, but abnormally sensitive to slight, irritation. Thus the touch of a pin may be experienced as pain, while penetration through the skin is scarcely felt at all. The perception of pain may be also very much delayed.

Paræsthesiæ are much more common. Sensations or anomalies of sensation in the soles of the feet are very frequent. Patients speak of walking on cushions, on wool, on ovals, girdle sensations, etc. The paræsthesia is usually in the direction of an anæsthesia, and the loss of sensitiveness concerns also the deeper tissues as well as the skin. So a disease of an internal organ may give rise to no distress; a pleurisy may be painless.

The loss of the power of co-ordination constitutes a symptom so striking as to have given the name to the disease. It shows itself first in the legs, and gives to the patient a *characteristic gait.* The regulation of nerve force to muscular contraction is so nicely adjusted as to be unconscious and automatic. In locomotor ataxia the course of the impressions through the cord to the brain is broken into and interrupted, so that the patient must aid his estimate of effort with the sight. Many of these patients stumble and fall on raising their eyes from the ground at their feet. So, too, the legs are lifted with unnecessary force, and the feet are planted flat in a kind of mechanical way. To broaden the base of support, the patient must stand with the feet more widely separated, and in the further course of the disease he must invoke the aid of a cane that he may get the firmer support of a tripod. So the diagnosis of locomotor ataxia may often be made upon the streets.

All the symptoms of inco-ordination become much more manifest when the patient withdraws his sight, and one of the early signs of the disease is the *inability to stand still with the eyes closed;* in all cases swaying is much increased, and in marked cases the patient, unless supported, would fall. The ability or inability to stand upon one foot or walk backward, or make special motions with the foot while the leg is supported by the hand in the sitting posture, are signs of value, but of less value. In the course of time the inco-ordination affects also the upper extremities. It is noticed, of course, in the finer movements first. The deftness and dexterity of the hand

are lost. This loss is observed more especially in the automatic movements of the trades, in writing, piano playing, in dressing and undressing, especially in buttoning and unbuttoning garments.

The single symptom of supreme value is the diminution or loss of reflex, as manifest more especially in the absence of the patellar reflex, "loss of knee jerk." *The patellar reflex is first diminished and then lost.* In the earlier history of the disease this diminution and loss is more marked on one side than the other. Total loss of knee jerk in a patient affected with a nervous disease should always suggest locomotor ataxia first. The symptom is universally present, and is best elicited by a stroke upon the patellar tendon as the patient sits upon a table with the legs hanging over the side. In people of ordinary build it is sufficiently distinctly brought out in the sitting posture with the legs crossed, and in patients in bed it may be estimated by support of the thigh with the left hand while the right is used to give the blow. What reflex there is may be always reinforced by simultaneous use of other muscles, as by a firm grasp of the hand, tight closure of the eyes, etc. The ankle clonus is diminished and lost in the same way. The skin reflexes suffer likewise, so that in an advanced case even tickling of the foot may provoke no withdrawal of the leg. In this connection may be mentioned also the *loss of sexual power*, which may even precede for months the atactic signs. In exceptional cases the sexual power may be preserved up to the period when the patient may no longer walk alone.

FIG. 281.—Knee jerk after tap on patellar tendon; dotted line represents response.

Symptoms on the part of the eye occur in the large proportion of cases. The reflex of the iris is lost in five-sixths of all cases, while at the same time the power of accommodation remains. This *loss of response to light, with preservation of accommodation*, first discovered by Argyll-Robertson and commonly known by his name, is a characteristic sign of the disease. Irritation of the skin at the back of the neck no longer produces dilatation of the pupils. In these cases of loss of reflex dilatation the pupils are commonly contracted, and "pinhead" pupils (spinal myosis) should suggest locomotor ataxia. It is needless to state that this condition is not necessary. The pupils are sometimes dilated, more frequently normal. *The eye muscles are affected in every degree*, from slight transitory paresis to total palsy. *Atrophy of the optic nerve* is the most distressing

complication of locomotor ataxia. It sometimes begins very early in the history of the disease, and may itself suffice, without the existence of other signs, to foretell the disease. The atrophy is at first peripheral, but with the slow progress of the disease may become total. The only consolation connected with these apparently unconsolable cases is the evident arrest of the progress of the disease in the cord; for, in the presence of optic atrophy, the degenerative process in the cord is usually brought to a standstill. The other cerebral nerves are rarely affected in this disease.

The mind remains unaffected and becomes quickly resigned to the ravages of the disease. A kind of jocund indifference has been remarked of most cases. The vegetative functions are usually normal, the appetite is good, the bowels are sluggish and must often be aided by cathartics and injections. Sooner or later the bladder be-

FIG. 282.—Tabes; perforating ulcer of the foot (Gowers).

comes involved, at first the detrusor, later the sphincter, so that incontinence or retention of urine may occur. Close attention must be paid to the bladder in these cases to prevent overdistention and cystitis. Atrophic changes, especially eczematous eruptions in the skin; softening of bones and alterations of joints; excruciating, paroxysmal pains in the internal organs, larynx, stomach, kidneys, etc.; so-called "crises"; perforating ulcers, especially of the feet, are more uncommon signs.

Locomotor ataxia is a disease of long *duration*, often of many years, and, though it may undergo arrest at various stages of the disease, it remains entitled to the term progressive given to it with its name. Recovery occurs only in the most exceptional cases.

In pronounced forms the *diagnosis* is easy. The lancinating pains, loss of the knee jerk, immobility of the pupils, are the cardinal signs. The reduction of sensibility, especially of deep sensibility, the various paræsthesiæ, the amblyopia and amaurosis, the affections of

the bladder, impotence, and ataxia, with at first preservation of power, unmistakably stamp the character of the disease.

Treatment, so far as cure is concerned, offers but little promise, but treatment may alleviate the symptoms and possibly arrest the progress of the disease. As locomotor ataxia is a sequel to, rather than an effect of, syphilis, antisyphilitic treatment has over it little or no control. Nevertheless the treatment should be faithfully tried. Mercury should be administered by inunction, and iodine should be pushed to tolerance. The hope in this connection lies in a longer treatment of the syphilis itself, whereby the poisons it leaves may be in the course of time thoroughly destroyed. The patient should be protected against cold and fatigue; attention is to be paid to the diet and digestion. Excess of any kind, especially sexual excess, must be avoided. Warm baths are of great value. Of the host of drugs recommended arsenic is the best, and Fowler's solution is the best form of it. Many cases improve under it rapidly for a time. It should be given in small doses, gtt. ij.–v., over a long time. Pains may be controlled by phenacetin gr. v.–x. Quick relief is sometimes obtained by the application of excessively hot water, or better by the injection of cocaine gr. $\frac{1}{4}$ subcutaneously at the site of pain. Severe pains are controlled only by morphia subcutaneously. Visceral pains may be addressed in the same way. Laryngeal spasms may be relieved by the nitrite of amyl or nitroglycerin. Paresis of the bladder is best overcome by strychnia, which is best given subcutaneously in small commencing and progressively increasing, gr. $\frac{1}{100}$–$\frac{1}{40}$, doses. Impotence is often quickly relieved by extension—that is, by suspension—which has in nearly all cases good effects in every direction. Unfortunately, however, suspension in no way really controls or cures the disease.

HEREDITARY ATAXIA.

Hereditary ataxia (*ἀταξία*, disorder) was first described by Friedreich (1861). It is, as the name implies, transmitted by heredity, and shows itself in several members of the same family, though individual cases are sometimes observed. The lesion is in the posterior lateral columns, and the effect is observed in the legs in incoordination and frequent falling. The disease extends to involve the upper extremities, the trunk, finally the tongue. Pains are dull and localized. Sensation is not disturbed. The disease is distinguished from locomotor ataxia by the fact that it occurs in childhood, progresses even more slowly, and is unattended with shooting pains, affection of the bladder or of vision; it has no crises and no arthropathies.

LATERAL SCLEROSIS.

Lateral sclerosis; spastic paraplegia; spastic spinal paralysis.—A degeneration of the pyramidal tracts, characterized by paresis or paralysis of the lower extremities, with spastic contraction of the affected muscles; exaggeration of the tendon reflexes with slight reduction of electric excitability; without affection of the bladder or bowels, and without trophic change.

History.—This degeneration was first observed by Türck (1856), afterward by Charcot (1865), but was more distinctly isolated by Erb (1875). The disease may occur at any period of life, but is most common at from twenty to forty years of age, decades which include three-fourths of all the cases. Very exceptional cases may occur as early as infancy and as late as the age of sixty.

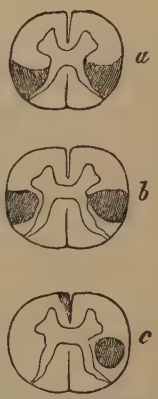


Fig. 283.— Scleroses on cross section of the lateral columns of the cord: *a*, *b*, *c*, sclerotic patches.

Etiology. — The cause remains involved in obscurity. The congenital form is always due to injury of the brain in birth. Syphilis could be considered a cause as rarely as it is frequent in posterior sclerosis (locomotor ataxia). A certain percentage of cases could be attributed to trauma, fall, blow, or concussion, after which, with the lapse of a long interval, sometimes of several years, the disease has been known to develop. In the absence of other discoverable cause it has been ascribed to exposure to cold, to chronic rheumatism or other protracted or exhausting disease. The symptoms of spastic paralysis may show themselves in connection with the other symptoms of chronic hydrocephalus, transverse myelitis, multiple sclerosis, and other diseases of the brain and cord of more distinct anatomical lesion; for the view that this spinal paralysis depends upon a sclerosis of the pyramidal tracts or lateral columns is rather an inference than a demonstration, as the cases reported to rest upon an anatomical basis by actual demonstration are not entirely free from objection.

Symptoms.—The disease begins with *weakness of the legs*, early fatigue, and unsteadiness, and progresses so slowly as to make itself distinctly manifest only in the course of several months. In many cases some kind of locomotion is preserved for years. The progressive paresis is *unattended with atrophy*, but is distinguished by an *excessively heightened reflex excitability.* A stroke upon the patellar tendon calls out powerful extension with subsequent convulsive movements. Rectus clonus and foot clonus are also easily

excited. This excitability is manifest with every action of the muscle, and is noticed first as stiffness of the legs upon rising in the morning. It varies in every degree from slight muscular twitchings to tetanic rigidity, and is so constant as to be absent only in cases of complete flexion and relaxation. With the first attempt at extension the spasmodic condition renews itself at once, and so powerfully as often to spring the leg into a state of complete extension, the condition known as "clasp-knife" rigidity. In advanced cases the reflex shows itself also in sleep, when the legs may be suddenly jerked up in bed. The surface shows also more or less intensely heightened reflex. But with all this disturbance on the part of the motor system, the sensitive and secretory centres are unaffected, there is never the slightest ataxia, there is no impotence, no affection of the bladder or bowels, and no disturbance of the brain or organs of special sense. The development of any of these symptoms, or symptoms on the part of these organs in exceptional cases, belongs to complications.

The *gait* is characteristic. The spastic contraction neutralizes the action of the joints and fixes the partially flexed leg as if by ankylosis. The patient steps upon his toes, and advances with a series of short hops, the whole body leaning forward, with a constant tendency to stumble and fall; the legs are closely pressed together and are only separated with difficulty, as if being pulled apart in progression. This *habitus* of the body in locomotion is so distinctive as to establish the nature of the disease at a glance. The upper extremities remain, as a rule, unaffected, but may show in the course of years the same spastic contractions. The muscles of the trunk may also become involved, and a tap on the chin may evoke sudden closure of the lower jaw. When the disease occurs in infancy it is recognized in the same way, by the sudden extension of the leg, which may shoot out to a straight line as the child is seated upon the lap or a chair.

Diagnosis.—This sclerosis is distinguished by gradual onset, a fact which at once eliminates cases in which symptoms suddenly develop; by the growing weakness, with spasmodic contractions and heightened reflexes, while at the same time the muscles do not waste and the bladder and bowels remain unaffected. The disease is distinguished from the paraplegia of hysteria, aside from considerations of history, age, and sex, by the remarkably strict confinement of the spasm to acts of extension; the spasm ceases in relaxation. Rectus clonus and ankle clonus are almost unknown in hysteria. The duration is indefinite.

Prognosis.—The disease is persistent, yet it may not much curtail life. Recovery, which is the rule in infantile forms, may occur only in very exceptional cases in adult life.

Treatment.—Rest is the most valuable agent. Exercise should be rather passive than active ; riding is better than walking. Massage, especially by upward rubbing, with warm baths, especially Turkish baths, are remedies of value. Recoveries have been reported under the long-continued, systematic use of massage, hot baths which excite sweating, and gentle exercise. The only drug worthy of mentioning in connection with the disease is arsenic, which at least aids digestion and supports nutrition. Electricity in any form is useless, if not injurious. The muscles are already overstimulated.

Ataxic Paraplegia is a combination of posterior and lateral sclerosis, which begins with the signs of lateral sclerosis—*i.e.*, with spastic excitability—and soon shows the ataxia but not the pains or loss of reflex of posterior sclerosis. Thus the knee jerk persists or is increased. The cause is probably a chronic toxæmia. Foundation for this view is furnished in the disease known as *pellagra*, an Italian endemic, which shows symptoms of ataxic paraplegia, is attended by degeneration of the posterior and chiefly of the lateral columns of the cord, and is clearly caused by a toxine ingested with diseased maize. Ataxic paraplegia is not caused by syphilis. The prognosis and treatment are the same as for lateral sclerosis.

PROGRESSIVE MUSCULAR ATROPHY.

Wasting palsy ; amyotrophic lateral sclerosis.—Characterized by atrophy of certain muscles without paralysis, or with but that degree of paralysis which corresponds to loss of substance, with fibrillar twitchings, with the reaction of degeneration, with reduction of the reflexes, with preservation of sensation, and normal action of the bladder and bowels.

History.—Hippocrates noticed this atrophy, but Van Swieten was the first to separate it from simple emaciation. Bell (1830) distinguished it from a paralysis. Cruveilhier considered it a spinal disease. Aran (1850), who first named it progressive muscular atrophy, located the disease in the muscles, as did also later Duchenne (1849), and still later Friedreich (1873). Lockhard Clarke (1862) located the disease in the spinal cord, and Charcot (1874) distinguished it as an atrophy of ganglion cells and thus definitely determined the lesion of the disease.

Etiology.—An important rôle is played by heredity ; the disease is sometimes transmitted through many generations. It may occur occasionally at any period of life, but is most frequent between thirty and fifty years of age. Cases have been recorded of inception at twelve and seventy, but such cases must be regarded with suspicion, as age secures almost absolute exemption. Men are affected more

frequently than women, in the proportion of five to one. But thirty-three of the one hundred and seventy-six cases collected by Friedreich were females—a disproportion evidently due to the greater use of the muscles in men. The working class, especially hand workers, furnish the majority of cases. The influence of mental distress, sexual excess, syphilis, trauma, exposure to cold and wet, has been distinctly noticed in individual cases. The disease has followed in the course of typhoid fever and diphtheria, and has occurred more frequently in connection with, or as a consequence of, other organic neuroses, as bulbar paralysis, infantile paralysis, in the history of the individual, arrested since infancy.

Symptoms.—The onset is insidious and imperceptible. The disease begins in the muscles of the upper extremities, in the right oftener than in the left, and shows itself as a feeling of weakness, sometimes preceded by pains or sensations of coldness, with loss of substance. The weakness and wasting come and go together—that is, *the weakness is due to the wasting.* The disease is distinguished by the particular muscles or group of muscles which it first selects. The weakness is first noticed in the shoulder, the wasting in the hand. The process begins in nine-tenths of cases either in the shoulder or in the hand, and is about equally frequent in each. Of the muscles of the hand the first attacked are the *interossei* and the muscles that constitute the *ball of the thumb*, the opponens and adductor, muscles which constitute the thenar and hypothenar eminences. The wasting of these muscles impairs the power of the hand, at first for delicate movements (writing), later for all movements. At the shoulder the deltoid suffers first and most. The loss of substance *flattens the shoulder and thins the hand*, to make conspicuous the bony prominences of the acromion, and in the hand to make manifest first the ends and later the whole shaft of the metacarpal bones, which, with the grooves between them, present the appearance of a skeleton hand. In exceptional cases the disease may begin in other muscles of the arm or leg, if invited thereto by particular strain. Wherever it begins, it gradually extends, generally centrifugally—thus, from the hand to the forearm, arm, and shoulder, and from the foot to the leg and thigh. The disease progresses symmetrically, though not absolutely uniformly, as fibres and groups of normal tissue may always be seen in the midst of degenerated masses. In all uncomplicated cases the muscles of the face and neck, the diaphragm, and rectus abdominis are the last, if at all, attacked.

Where the muscles of the back, especially of the back of the neck, are affected, as may sometimes happen first, the patient has difficulty in sustaining the head upon the vertebral column, and in

the effort must tip the head somewhat backward. So soon as the balance is lost the whole head falls forward, with the chin upon the chest, and is with difficulty restored. In advanced cases the muscle substance is completely wasted and seems to entirely disappear, to reveal distinctly the subjacent outlines of bones. Over all the affected muscles may be seen *fibrillary twitchings*—slight contractions which show themselves spontaneously, or, upon exposure of the surface, under the slightest irritation. They may be always called out by drawing the wet finger over the surface and blowing upon it. It is nothing in the nature of a contraction which moves the limb. Functional or spasmodic contractions are almost never seen. It is merely a superficial, flickering movement, and is of value in that it sometimes shows itself in muscles not yet, but about to be, involved in the disease. Though there is no loss of sensation, the reflex is lost with the advancing waste of muscle and loss of motion. The *reaction of degeneration* sets in very slowly and corresponds to the degree of destruction. Peculiar *deformities* are caused by the wasting of individual muscles or groups of muscles, while their antagonists are spared. The most characteristic of these changes is seen in the *claw hand*. Vaso-motor and trophic disturbances are frequent. The atrophied members are *cold, often cyanotic*, more rarely covered with sweat. The skin is often the seat of eruptions, and the bones and joints may show trophic change.

Morbid Anatomy.—The disease consists, in essence, of a degeneration of motor ganglia in the pyramidal tracts. The motor cells seem on inspection to have almost entirely disappeared ; sometimes not a single large cell may be seen. The affected muscles show the signs of fatty degeneration. The striæ are separated, absent, or substituted by granules, and fat globules accumulate throughout the structure. The *preservation of bundles of normal tissue in the midst of this waste* is characteristic of the disease.

In *diagnosis* the disease is to be separated from traumatic lesions of the ulnar nerve, which show the same deformity in the hand, but always, of course, in but one hand; from rheumatic affection, which may show it in both, but would not involve other muscles in the order of frequency, and would be distinguished by the presence of pain. The slow development, order of progression, and limitation to the motor system define the disease.

The *prognosis* is bad. Arrest may occur, with recovery and restoration by hyperplasia of unaffected fibres ; but recovery is rare. The disease is, as its name indicates, progressive, and is in its later course usually complicated with bulbar paralysis with its necessarily fatal prognosis.

Treatment.—The body is to be supported with food and fresh

air. Anxiety and fatigue must be avoided. Gentle massage is of value, as is also the use of electricity, which, in the mildest constant currents, sometimes suffices to arrest the disease. The only drug worthy of mention is strychnia, which should be used subcutaneously in the form of the nitrate, in small doses at first, gr. $\frac{1}{100}$, increased to gr. $\frac{1}{40}$, once a day. The dose must be kept down to avoid overstimulation, and every intervention must be mild, persuasive, rather than forcible.

INFANTILE PARALYSIS.

Poliomyelitis (πολιός, gray); essential paralysis of childhood; acute anterior poliomyelitis.—A rapid paralysis with atrophy, chiefly of one or both lower extremities, more rarely of an upper extremity or of one side of the body, with loss of the reflexes, but preservation of the action of the bladder and bowels; with the reaction of degeneration; with intact sensation; sometimes with deformities from contractures of unaffected muscles. The disease, which is certainly an infection, may begin with fever or convulsions.

History.—Heine (1840) wrote the first monograph in which the symptoms were associated to constitute a separate disease. Cornil (1863) first saw lesions in the spinal cord. Prévost and Vulpian (1865) located the lesion in the anterior cornua—a localization subsequently confirmed by Lockhard Clarke (1868) and Charcot and Joffroy (1870) as the true seat of the disease. Duchenne (1872) observed the affection also in adults.

Etiology.—Age is the most important factor; six-sevenths of cases occur within the first three years. The disease is rare before four months, but has been observed as early as the twelfth day. It is rare in after-childhood, and is very rare in adults. It is more frequent in summer than in winter, and has thus been attributed to cold, as after exposure at night in bed. It has been noticed to occur in a few cases within a few days after exposure to cold, as from a draught, from sitting upon damp ground, etc. Attacks after fatigue, trauma, and during dentition are probably coincidences. More close is the relation of the infections, which more distinctly liberate some toxic element to produce the disease.

Morbid Anatomy.—The process is closely limited to the gray matter in the anterior cells, where it attacks and destroys the multipolar ganglion cells. The cells lose their poles, shrivel, and are filled with pigment and granular matter. The disease may extend to involve the lateral columns. There is an increase in the connective tissue, with strangulation and destruction of nerve elements. Whole bodies of cells seem to have disappeared or be substituted by corpora amylacea. The paralysis and wasting are to be directly

attributed to the destruction of the multipolar ganglion cells in the anterior cornua. The process shows its main expression in the lumbar enlargement, next in the cervical, and last in the dorsal portions of the cord. It is not, as a rule, symmetrical. It is usually focal, but may be for a short distance funicular.

Symptoms.—The disease begins as an infection, with toxic signs —*i.e.*, with *fever, headache, restlessness,* sometimes with stupor, delirium, and convulsions. Individual cases are announced with anxiety and pain. *Vomiting* is common, sometimes with *diarrhœa,* so that the case may be interpreted as a mere gastro-intestinal catarrh. These symptoms may be slight or pronounced. They may last for several days, and some time in the course of them the characteristic symptoms develop. It not infrequently happens that the child is put to bed indisposed or ill, and wakes up paralyzed. It is observed that the child has lost the power of motion from one or both legs. Sensation is unaffected. The *paralysis develops rapidly,* but is always worse at first ; not infrequently the paralysis extends from one to other members. There may be incontinence of urine from affection of the bladder. But the advance of the disease is soon checked. It is a characteristic of this spinal paralysis that it soon *comes to a standstill* and recedes to some extent. Power over the bladder is quickly regained ; the paralysis may disappear entirely in the course of a few weeks or months. As a rule, however, the *improvement is only partial,* and enduring paralysis is left.

The changes of *atrophy* now intervene. The wasting process is marked, the skin is cold and purple, the surface is often mottled, and all the reflexes are lost from disruption of the muscle reflex centre in the gray matter of the cord. The atrophy is more rapid than after section of the nerves, and is associated with the development of the *reaction of degeneration. Development is arrested* in all parts of the affected member. Bones cease to grow, in fact they actually diminish and show deformity in comparison with the sound limb, which continues in normal development. The varieties of talipes, with various scolioses, may form for life. Under all this wasting process the brain remains unaffected, and with the subsidence of the acute signs at the start all the functions of the body remain normal. In adults the symptoms of the onset are less pronounced and the distribution is more irregular. Sometimes the paralysis is crossed, or one side of the body is affected, or nerves usually spared are involved ; thus the facial may be attacked, and characteristic changes show themselves in the face. In children the disease *affects the legs three times as often as the arms,* the left leg twice as often as the right. Irregular distributions are more uncommon.

Diagnosis.—The rapid paralysis and atrophy in close association distinguish the disease. It is especially to be remarked that the symptoms are always worse at the start; that afterward the disease subsides to some extent. The disease is non-progressive, though it finally leaves permanent lesions. In two-thirds of cases the lesion is confined to one member, and in even the worst cases there may be usually discovered fibres or bundles of unaffected, or but slightly affected, muscles.

The association of paralysis and atrophy, both rapid in onset and marked, often extreme, in degree, whether preceded or not by general signs, sufficiently distinguishes the disease.

The *prognosis* is good so far as life is concerned, but bad concerning recovery. The amount of lesion to be left may be deter-

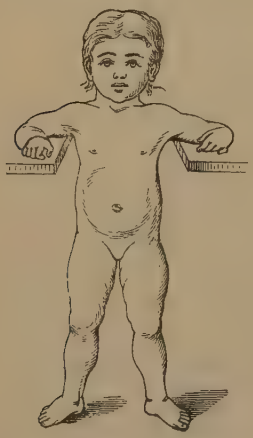


FIG. 284.—Posture of healthy child.

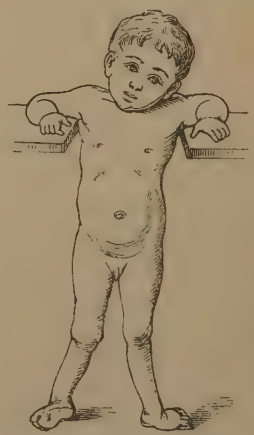


FIG. 285.—Posture of infantile paralysis; supported by the arms.

mined only after the subsidence of the acute signs at the onset. Muscles which at that time still respond to faradization will probably recover; muscles which fail to respond, or respond but very feebly, will recover in part or not at all. The degree of atrophy will determine the prognosis later on. Loss of power after three months indicates destruction of nerve cells. Response to faradization at any time leaves possible a certain degree of recovery.

The *treatment* of the first stage is wholly symptomatic. Warm baths, broken doses of Dover's powder, the salicylates, salicin or salol, may to some extent counteract the fever, the toxines, and their associate signs. With the subsidence of the acute stage after the lapse of three or four weeks, treatment is directed to the paralysis with strychnia and electricity. Strychnia should be given in small doses, one-one-hundredth of a grain, at first, and gradually increased but not

pushed, and by the mouth rather than subcutaneously. Electricity acts with more direct relief by support of the muscle. It should be used in the form of the galvanic current, and applied both to the spine and the muscle, negative pole at the spine. The central effect is best obtained by the application of electrodes above and at the level of the disease in the cord. The peripheral is applied best in the form of the labile current, with one sponge at the entrance of the nerves and the other stroked over the body of the muscle, the sponge being lifted from the skin with each stroke. The current should be feeble, that from but a few cells, at first, and gradually increased to many cells, as many as may be borne. Occasional reversal of the current assists in the process. The treatment requires great patience, but should be persisted in under the very slightest encouragement, as it offers the only hope of relief from deformity and restoration to use. Frictions, massage, and stimulating applications help to sustain the circulation. Cod-liver oil and phosphorus are indicated in debilitated, more especially in rachitic, cases. Orthopædic devices may relieve deformities in helpless cases and enable the patient to get about, and thus sustain the general health.

BULBAR PARALYSIS.

Glosso-labio-laryngeal paralysis (Trousseau).—A sclerosis of the medulla, distinguished by progressive paralysis and atrophy of the muscles of the tongue, lips, larynx, and pharynx, with increased mechanical and reduced electric excitability, with the reaction of degeneration and reduction of reflex.

With the other scleroses, the *etiology* of this affection is involved in obscurity. The disease occurs more frequently in advanced life, is rare before thirty, and attacks men more than women. Bulbar paralysis has also been ascribed to exposure to cold, excesses, and fatigue, without other proof of cause than sequence. The disease is a degenerative atrophy which successively involves the centres of various cerebral nerves; hence it has been called a progressive paralysis of the cerebral nerves (Benedikt). The centres attacked are, in the order of frequency and severity, the hypoglossus, facial, spinal accessory, pneumogastric, glosso-pharyngeal, more rarely the abducent, and the motor part of the trigeminus. The auditory nerve is never affected.

Morbid Anatomy.—The atrophic process leads to a destruction of the contents of the great ganglion cells. Nuclei and protoplasm actually disappear to leave only granules and pigment matter. There is hyperplasia of the connective tissue, thickening and atheroma of the vessels. The degenerative process extends into the axis

cylinder of the nerves, and the muscles supplied by them suffer granulo-fatty atrophy.

Though this atrophic process may not be regarded as the primary affection, it is impossible as yet to discover its cause. It has been found by Benedikt in connection with basilar meningitis, and is frequently associated, often as the terminal process, with progressive muscular atrophy, lateral sclerosis, paralytic dementia, etc.

Symptoms.—The disease begins very insidiously, and is marked at first with the *difficulties of speech* which arise from affection of the hypoglossus. Sounds which require the use of the tongue suffer first: to wit, of vowels, *i;* of consonants, first *r*, later *s*, *l*, *k*, *g*, *t*, and lastly *d* and *n*. Affection of the facial produces difficulty with the pronunciation of, first, *u*, later *a*, and of the consonants *p*, *f*, further with *b*, *m*, and *v*. Paralysis of the palate gives rise to the *nasal voice*, and affection of the accessory produces paresis of the vocal cords and muscles of the larynx. *The lips lose power* to whistle or to blow out a light; the face loses expression. The difficulty with mastication from paresis of the tongue and lips leads to accumulation of food and lets it drop from the mouth. Saliva is freely discharged, or must be continuously wiped away. The paralysis of the vocal cords interferes with respiration and leads to *difficulties of expiration and to dyspnœa.* The affected muscles show the same *reactions of degeneration* and *fibrillar twitchings* as in progressive atrophy.

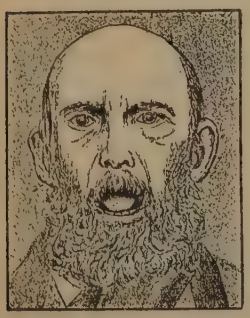


Fig. 286.—Bulbar paralysis; maximum protrusion of tongue (Gowers).

A rare variety of bulbar paralysis, which shows itself in acute form, occurs in connection with hæmorrhages in the medulla and pons, from thrombus and embolus in the domain of the vertebral, anterior spinal, and basilar arteries. This *acute bulbar paralysis* shows, in connection with the signs of involvement of the cerebral nerves, *hemiplegia* with opposite facial paralysis, *hemiplegia alternans;* or crossed paralysis of the upper and lower extremities, hemiplegia cruciata, with bilateral paralysis. The signs of an acute paralysis may occur also in connection with, though as a very rare complication of, disseminated myelitis. The disease is then announced with the same irritative signs—headache, vertigo, etc.—followed by paralysis of the various nerves that issue from the medulla, with rapidly fatal termination.

The *diagnosis* rests upon the successive involvement, in regular progression, of various cerebral nerves, beginning with the hypoglossus and ending with the trigeminus, or extending further to

involve the anterior cornua in the spinal column, in association with symptoms of progressive muscular atrophy. The relation is usually the other way. The muscular atrophy precedes the bulbar paralysis.

Bulbar is distinguished from multiple sclerosis, or tumor with pressure upon the medulla, by the different advent of these affections, and the involvement of other nerves than those affected in bulbar paralysis. Headache, vertigo, vomiting, convulsions, with affections of the auditory nerve and sensitive portions of the trigeminus, paralysis and contractions without muscular atrophy, belong to these diseases, but not to bulbar paralysis.

The *prognosis* is absolutely bad. The disease extends over a period of two to five years, with a constant tendency to progression, though it may come to a standstill and seem to be arrested for several months at the beginning of the disease.

The *treatment* consists in a use of the galvanic current and the subcutaneous injection of strychnia, after the manner already specified in connection with other scleroses.

ACUTE ASCENDING PARALYSIS.

A paralysis which begins in the lower extremities and ascends rapidly to involve the body and upper extremities, in the absence of all discoverable lesion in the spinal cord. This paralysis was first specialized by Landry (1859), and is often called Landry's paralysis.

Etiology.—The disease is assumed to be an infection, the nature of which is unknown. Support of this view is furnished in the frequent presence of enlargement of the spleen common to most infections, and occasional attacks of fever and sweating. It is more common in males and in the period between adolescence and maturity.

Symptoms.—The paralysis begins as a *weakness of the legs*, and *extends* so *rapidly* as to take the patient off his feet in the course of twenty-four to forty-eight hours. The weakness is noticed next in the pelvis, and rapidly ascends to involve the whole trunk and upper extremities. In all cases the *paralysis is pronounced;* in the lower extremities it is usually absolute. The process may stop at the cervical cord, but extends often to involve the medulla with the centres of articulation, deglutition, and respiration. The unfortunate patient, with full consciousness, may no longer express his wants; he is unable to swallow and suffers attacks of dyspnœa or succumbs to suffocation. Sensation is affected in much less degree. The paralysis may be preceded by paræsthesia, especially by numbness and tingling in the extremities, but the sensation of touch is usually preserved. The *reflexes disappear* and remain lost in cases rapidly fatal, but return gradually with recovery. The sphincters usually

escape. Notwithstanding the intensity of the signs, there is *little or no trophic change;* the muscles do not waste, electric excitability is not lost, and bed sores do not develop.

The *prognosis* is very grave. The paralysis may extend to involve respiratory or cardiac centres, and thus prove fatal in the course of two days. The duration on the average is less than a week. Recovery, when it occurs, is rapid only in exceptional cases. As a rule it is exceedingly slow and extends over a period of several months.

Treatment is of little avail, as the course of the disease is determined by the nature or amount of the infection, and may be but little influenced by drugs. It is advisable to push the salicylate of soda and to administer warm baths. The bichloride has been recommended in small and frequently repeated doses, or, where mercury is contra-indicated, the perchloride of iron.

SPINAL HÆMORRHAGE—HÆMATORRHACHIS; HÆMATOMYELIA.

Hæmorrhage may occur in any part of the cord substance or membranes, where it may be extra- or intrameningeal. Meningeal hæmorrhage, hæmatorrhachis, is chiefly due to injury, fractures, falls, etc., but sometimes occurs after the straining efforts of violent convulsions. As miliary aneurisms do not develop in the course of the vessels, hæmorrhage into the substance of the cord—hæmatomyelia—is rare. But it may occur at any age from infancy to advanced life, most frequently in adolescence and early maturity. Trauma is the most frequent cause. In exceptional cases hæmorrhage has been observed after excesses in venery.

The *symptoms* depend upon the seat and extent of the effusion. Hæmorrhage is usually announced by *sudden and violent pain* in the back and along the course of the nerves which issue from the seat of the lesion. *Spasm, rigidity, convulsions,* may immediately supervene and be followed by *rapid paralysis, paraplegia.* In exceptional cases the brain may be affected indirectly from upward displacement of the cerebro-spinal fluid. Symptoms occur, as stated, suddenly, and develop rapidly, to reach their height in a few hours or days with fatal lesions, or, in favorable cases, with gradual recovery in the course of a few weeks.

Diagnosis.—Meningeal hæmorrhage is distinguished by the prominence of pain and irritation. In hæmorrhage into the cord paralysis is the most prominent sign; fever, which develops early, speaks rather in favor of myelitis.

The *prognosis* is always grave, and is determined early in the history of the case. Effusion into the cervical region is especially

grave. The return of sensation is a favorable sign; evidence of trophic change is unfavorable.

The *treatment* is absolute rest, recumbent, with an ice bag to the spine, and attention to the secretions. A subcutaneous injection of ergotin or sclerotinic acid may secure contraction of the vessels and check the hæmorrhage.

SYRINGOMYELIA.

Syringomyelia (*σῦριγξ*, pipe) ; gliomatosis of the cord.—A disease marked by anæsthesia and muscular atrophy, and distinguished by the presence of cavities in the spinal cord. These cavities have been variously interpreted as arrest of development, defective closure, Olivier (1827) ; the results of sclerosis, Hallopeau ; neoplasm, glioma, Grimm (1869) ; in Brittany as the result of leprosy. The disease was associated with distinct symptomatology by Kahler and Schultze (1882).

Morbid Anatomy.—The cavities are usually found in the posterior parts of the cord, and result clearly from a glioma or gliosarcoma which has broken down and disappeared. The cavity is generally lined with a delicate covering layer containing glia cells, and not infrequently communicates with the central canal of the cord.

Symptoms.—Syringomyelia is usually announced with paræsthesia, especially with *diminution or loss of sensation to pain and heat.* Thus burns are not felt, and are discovered only by the destruction of tissue. Asmus reported a handsomely illustrated case (Bibliotheca Medica C. Heft 1), marked also by anæsthesia of the conjunctiva and cornea. *The sense of touch and the muscular sense are commonly unaffected.* The *atrophy of muscle* occurs later ; it shows itself in the hand and shoulder, and advances in the order of progressive muscular atrophy. *Trophic changes* are common. Surfaces of the body may be cold and cyanotic ; the joints may swell. The patient succumbs to bed sores, cystitis, and marasmus.

The *diagnosis* rests upon the loss of sensation of heat and pain, with preservation of the sensation of touch, and the characteristic muscular atrophy. The arthropathies, in distinction from tabes, are chiefly confined to the upper extremities (Sokoloff).

Treatment is wholly symptomatic.

ACROMEGALY.

Acromegaly (*ἄκρος*, end, *μεγάλη*, great).—A disease distinguished by hypertrophy of the bones and tissues of the hands, feet, and face, with headache, drowsiness, melancholy, sweating, and thirst. The alterations were first described by Pierre Marie and

Souza-Leite (1891) with a record of forty-eight cases. Osborne (1892) reported the eighth case observed in this country. Acromegaly usually occurs between fifteen and thirty-five, and may be observed in several members of the same family. The enlargement of its bones imparts to the face a peculiar expression. The chin is prominent; the whole lower jaw protrudes. The trunk and the long bones are unaffected, though there is usually anterior dorsal curvature with compensatory lumbar lordosis. The stature is heightened, the abdomen projects. The hands are very much broadened, the fingers are uniformly enlarged; the nails, broad and short, scarcely reach the ends of the fingers. Among the curious anomalies of this condition are enlargement of the tongue, polyuria, sweating, and disturbances of special senses. The condition is ascribed to lesions of the spinal cord allied to those of syringomyelia.

MORVAN'S DISEASE.

A trophic disease, distinguished by destruction and deformity of the ends of the fingers. The affection was first described by Morvan (1883), later by Charcot. The disease shows all the signs of inflammation except pain. There are heat, redness, and swelling, but, as a rule, entire absence of pain, analgesia. The ends of the fingers suffer necrosis, the nails fall out, the hands may become blue. Anæsthesia and atrophy occur subsequently. The course is very slow; months, even years, may lapse while the disease extends from one finger to another.

The *pathology* is obscure. The affection is considered a sclerosis of trophic centres in the spinal cord.

Diagnosis.—Morvan's disease is distinguished from the destructive dactylitis of syphilis by the signs of syphilis elsewhere and by the absence of analgesia in syphilis; from leprosy—if it be not leprosy itself—by the signs of leprosy elsewhere, the patches and nodules over the body, and by the affection of the lower extremities in lepra; from syringomyelia by the absence of necrosis of bone, the presence of sensation, and the progressive muscular atrophy of this disease.

The *prognosis* is unfavorable.

The *treatment* is wholly symptomatic.

RAYNAUD'S DISEASE.

A gangrene of the extremities, sometimes of other parts of the body, distinguished by symmetrical distribution. The affection was first described by Raynaud (1862). It is considered a vaso-motor neurosis. The disease begins with pallor and paræsthesia in the first phalanges of the fingers or toes, sometimes also in the tip of the

nose and upper parts of the ears, which soon become cyanotic and œdematous. Gangrene and sloughing may supervene.

Diagnosis.—The effects of frost bite, which may simulate the condition, disappear with warm weather; the symptoms of Raynaud's disease, though aggravated by cold, persist.

The *prognosis* varies according to the extent and rapidity of spread of the disease. Recovery is possible in even the worst cases.

Treatment is wholly symptomatic. Vascular spasm may be relaxed by belladonna and the bromides, the action of the heart sustained by digitalis. Pain may be so severe as to require the use of morphia. The nervous system may be supported by strychnia. The general health must be held up by tonics.

BROWN-SÉQUARD'S PARALYSIS.

Brown-Séquard's paralysis is a paralysis of motion on the same side and of sensation on the opposite side of a lesion in the cord—*i.e.*, a hemiparaplegia with crossed anæsthesia. The condition is attributed to a lesion in the lateral half of the cord, and is explained by damage to the motor fibres in their downward course and to sensory fibres before decussation in their upward course. Crossed sensory and motor paralysis occurs only in injury or disease of the cord as low as, and below, the middle dorsal region. Motion, by transfer of nerve force through decussating fibres from the opposite side of the body, usually returns, while sensation remains lost.

Horsley accepts the symptomatology, but doubts the interpretation.

The *prognosis* is grave, yet cases of recovery have been reported.

PROGRESSIVE DYSTROPHY.

Dystrophy (δύς, mis-, τροφεῖα, nourishment) of muscle is a term employed to distinguish disease dependent upon affection of the muscle independent of nerves, that is, of myopathic as distinguished from neuropathic origin—a distinction that is by no means actually established as yet. The visible distinction lies in the fact that atrophy is attended with distinct reduction in volume, while dystrophy may be attended with an apparent increase in volume. Atrophy is distinguished by the occurrence of fibrillary twitchings and the presence of the reaction of degeneration in at least part of the affected muscles. Dystrophy is distinguished by the fact that the electric, faradic, and galvanic irritability is reduced or lost without a show of the reaction of degeneration. The chief types of dystrophy are: (1) pseudo-hypertrophy, (2) juvenile dystrophy, (3) hereditary atrophy, (4) facial atrophy.

1. PSEUDO-HYPERTROPHY of muscle is, as the name implies,

only an apparent increase of volume, as the muscular structure itself is reduced in amount and substituted by the abundant development of interstitial fat. The condition is commonly associated with progressive muscular atrophy, and shows itself in the lower half of the body, while the atrophy advances in the upper half. The disease always shows itself in early life—four times as frequently in boys—during the period of development, and is most frequently first observed in the first attempts to walk. The muscles of the calf of the leg are earliest and most affected. The enlargement may be very great, so that the leg of the boy is as big as a man's and is out of all proportion to the rest of the body. The infraspinatus is next most frequently affected, and is at times so much enlarged as to be mistaken for the scapula itself. The difficulty of locomotion is especially marked in the attempt to climb stairs—the child must pull itself up by the banisters—and is very manifest in attempts to lift itself from the floor, an act which is accomplished only by the use of all four extremities.

FIG. 287.—Pseudo-hypertrophic paralysis; big calves of legs (Putzel).

Especial stress is laid, in *diagnosis*, upon the great size of the infraspinatus with atrophy of the latissimus dorsi; next upon the enlargement of the muscles of the calf and loss of knee jerk. The disease shares the grave *prognosis* of other forms of muscular atrophy. It is progressive. After loss of the power of standing, seven years is about the longest duration of life.

The *treatment* is the same as that of progressive muscular atrophy.

2. JUVENILE DYSTROPHY occurs in adolescence and begins in the muscles of the upper extremity. It shows itself with the same increase in volume and diminution in force. The muscles especially affected are the deltoid, supra- and infraspinatus, teres major and minor, triceps, tensor faciæ latæ, sartorius, gastrocnemius. With the exception of the supinator longus, the muscles of the forearm

usually escape. Lipomatosis is not so pronounced as in pseudo-hypertrophy, but sclerosis is more common.

3. Hereditary Atrophy is a subvariety which occurs in later childhood and adolescence, is hereditary and affects a number of members of the same family, but otherwise is not different from forms already described.

4. Facial Atrophy—Duchenne (1872)—attacks chiefly the orbicularis oris; later the orbicularis palpebrarum, frontalis, levator nasi, zygomatici, and risorius, and may extend to involve the muscles of the shoulder and arm and even of the lower extremity. It is unilateral. The alteration thus effected in the face changes the phy-

Fig. 288.—Pseudo-hypertrophic paralysis; attempt to rise from floor (Putzel).

Fig. 289.—Pseudo-hypertrophic paralysis; patient "climbing up his thighs" (Putzel).

siognomy and gives the face the appearance of a mask. The fact that the atrophy occurs in youth, is hereditary, and coincides with sclerosis, lipomatosis, and hypertrophy, allies it to, or makes of it but a subvariety of, the dystrophies already described, from which it differs only in the fact that it first affects the face.

TETANY.

Tetany (*τείνω*, to stretch).—A disease characterized by painful cramp or spasm in the extremities, especially in the flexors, with excessive excitability of the motor nerves to mechanical or electrical irritants.

History.—Though described a half-century ago, the distinctive features were first distinctly emphasized by Trousseau, who gave it the name tetanilla, diminutive of tetanus. Corvisart (Lucien, 1852) first called it tetany.

Etiology.—Tetany is a disease of early life. It shows itself in infancy, and occurs with especial frequency in the first and second decades of life. At this period the disease is more frequent in males. After the age of twenty the ratio is reversed. Tetany appears to be a toxæmia, the result of exhausting discharge, though there is no proof for this view. It supervenes most frequently upon diarrhœa and lactation. In children it is connected with rickets; sometimes it follows attacks of typhoid fever, measles, small-pox, rheumatism, pneumonia. A curious sequence, too frequently observed to be a mere coincidence, is the occurrence of tetany after excision of the thyroid gland. Tetany is liable to develop within ten days after removal of the whole thyroid gland.

Symptoms.—The disease is usually announced suddenly, with spasms in the hands and feet. The hand is cramped to assume a posture so distinctive as to be called the position of tetanus. *The fingers, extended upon their own joints, are flexed upon the metacarpus.* The thumb is fixed against them; the wrist is slightly flexed. Thus the hand is brought into the so-called *obstetrical habitus*, as for introduction into the uterus to perform flexion. *The feet are extended and inverted*, to assume the position of talipes equino-varus. The toes are flexed, the knees extended. The spasm may extend to involve the muscles of the trunk; in severe cases, of the face; and in extreme cases, of the eyes and tongue. Sensations of *numbness and tingling* may precede the spasm, which, when fully developed, is always attended by *pain*. The attacks are *paroxysmal* and apparently spontaneous. They may occur in sleep. The heightened excitability is especially observed in response to a blow. A tap upon a muscle is followed by muscular contraction. This quick response constitutes the so-called Trousseau phenomenon. The compression of a nerve, in the act of compressing an artery, produces spasmodic contraction in the course of a few minutes. Sometimes this phenomenon is absent. Electric excitability is so much heightened that a current from a single cell produces contraction. The disease is intermittent, remittent, or more or less continuous; it may last but a few days or continue for several weeks, in exceptional cases for several months. Recurrence is not infrequent.

The *prognosis* is favorable. Tetany is distinguished from tetanus by the cause of tetany—diarrhœa, lactation, and exposure to cold; by the occurrence of spasm first in the hands and feet. Tetanus begins in the jaws. The obstetrical posture of the hand is peculiar to

tetany. Hysteria is unilateral; tetany is always bilateral. Epilepsy is attended with loss of consciousness and clonic convulsions.

Treatment is the relief of the cause. Diarrhœa is arrested by appropriate means; lactation is stopped; rickets is relieved with phosphorus and cod-liver oil. Severe spasms may call for chloral, or even subcutaneous injections of morphia; milder cases yield to the bromides, half a drachm in a glass of water three times a day. In nocturnal tetany no remedy is so useful as a dose of digitalis at bedtime (Gowers).

CHAPTER XIII.

DISEASES OF THE BRAIN.

APOPLEXY.

Apoplexy (ἀποπλήσσω, I strike down).—Sudden loss of consciousness from brain disease, with abolition of motion, sensation, and of special sense. The term as originally employed was wholly symptomatic ; but as in the course of time so many cases were found to be due to hæmorrhage in the brain, it got gradually a wider range, in that it was applied to rupture of blood vessels in other organs ; so the older writers spoke of apoplexy in the lungs, kidneys, retina, etc.

Brain apoplexy does not necessarily result from hæmorrhage, as the same stroke may follow embolus or thrombus of the cerebral arteries. Hence apoplexy may occur in consequence of rheumatism, alcoholism, and syphilis. An apoplectiform stroke may be the result of trauma, uræmia, poisoning by alcohol, chloral, opium, prussic acid, etc., so that a differential diagnosis becomes a necessity in every case.

Etiology.—True apoplexy in the majority of cases means cerebral hæmorrhage. Hæmorrhage implies a weak vessel and an increased force behind it, one or both. The first is by far the most important factor. The action of the heart, however strong, cannot break a sound vessel ; it might weaken it in the course of time and then finally break it. Frequently the increase in the force of the heart is a struggle against resistance from disease of the vessel, which prepares it for rupture.

The most important factor in connection with ordinary cerebral hæmorrhage is age. Four-fifths of cases occur after the age of forty, males preponderating over females in the proportion of three to two. If hæmorrhage from all sources be considered, the proportion is greatest in early life, infancy and about birth. The rupture here, however, concerns the meningeal vessels, as the result of strains connected with parturition.

Heredity plays a rôle of some importance, in that apoplexy occurs in certain families and is absent in others. Weak arteries may

be inherited as well as weak eyes, weak stomachs, and weak brains. Weak arteries bulge and break quicker under the same strain. Short, thick-necked, square-set, red-faced, heavily built men, the so-called *homines quadrati*, are popularly believed to have a special liability to apoplexy. They are said to have the apoplectic habit. The reverse is true. More often thin men of spare habit have weaker vessels in the brain. No outside condition, as accumulation of fat, atheromatous degeneration of radial or temporal arteries, arcus senilis, etc., indicates any greater tendency to apoplexy. Outside may coincide with inside atheroma and aneurism; the brain vessels may still not rupture. More frequently the conditions are independent of each other.

True apoplexy in the brain substance remains a disease of age. When it occurs earlier, in adolescence or maturity, it is the result of conditions which precipitate the arterial changes of age—chiefly alcoholism, syphilis, gout, and Bright's disease—so that the common expression, quoted elsewhere, "a man is as old as his arteries," has foundation in fact. The walls of the vessels suffer particular change in age. It is a question whether the change begins in the intima or the adventitia. In either case it is expressive of failing nutrition, which is felt in the blood vessels first. This failing nutrition may manifest itself in the blood vessels generally over the body, to constitute the condition known as arterio-capillary sclerosis, whereby, owing to the resistance and lack of resilience of the walls in the finer vessels, extra work is thrown upon the heart. The solution of the cause of the failing nutrition of age is the solution of the problem of life itself.

Fatty and atheromatous change occurs in the great blood vessels, first and most markedly in the aorta. This chalky, fatty degeneration may affect also the cerebral arteries and lead to final rupture. More frequently a peculiar change is noticed in the finer blood vessels given off in the substance of the brain. The wall of the vessels weakens in spots and bulges under pressure, to form minute, so-called miliary aneurisms.

Charcot and Bouchard demonstrated in the brain of apoplexy almost universally the presence of these miliary aneurisms, the rupture of which caused cerebral hæmorrhage. There are reasons why the vessels in the brain soonest suffer this change. In the first place, they are surrounded by semi-solid, almost diffluent substance, so that they lack external support. In the second place, fine arterioles are given off directly from large trunks, so that delicate-walled vessels must sustain the pressure of thicker trunks or tubes. Miliary aneurisms are detected on the walls of the smaller vessels by placing the brain substance with its clot in water, and gently agitat-

ing the water to wash away everything else. The twigs with their aneurism, like grains of red sand or minute drops of blood, float out to become manifest. As many as two hundred aneurisms have been counted in a single brain, rupture of any of which produces apoplexy. The tendency of the condition to recurrence is thus explained. The break is sudden, but the process which leads to it is slow, requiring months and years for its full development.

Any vessel in the brain, the great vessels at the base of the brain, arteries of the circle of Willis, or their immediate branches, may break. The rupture occurs most frequently in branches of these last-mentioned branches in the substance of the brain. Hæmorrhage may occur in any part of the brain substance. It does occur most frequently about the great ganglia and the island of Reil. A branch of the middle cerebral artery breaks so often as to have been called by Charcot the artery of hæmorrhage. Hæmorrhage may occur in the cortical substance, in the pons, medulla, most rarely in the cerebellum. The quantity of blood which may escape varies: a drop or two may exude, or such a mass be poured out as to tear up the brain substance, break into the ventricles, and form a pool in the brain. Blood may pour out *en masse* at once, or may ooze out gradually; or hæmorrhage may cease, to recur again and again.

Should the patient survive the shock and pressure, the clot undergoes the same subsequent changes as in other parts of the body. It may become encysted and shut off from the rest of the brain. Its contents may be transformed into a clear fluid. Such cysts are frequently seen upon autopsy. The blood may be entirely absorbed, when connective tissue may fill up the breach to leave a scar, discoverable also on autopsy. Slight losses of brain substance may be substituted by other cells and little or no damage may be left. The slightest loss is usually appreciated by the patient as loss of energy —so many battery cells have been cut out.

Sometimes irritative changes set in; sometimes secondary degeneration takes place about the clot; and the process may extend to the pons, medulla, and cord, with consequent impairment or loss of function. It is rare that a lesion may disappear to leave no trace. A severe lesion may take life at once, or the patient may be paralyzed and recover to suffer subsequent attacks.

Symptoms.—An attack of hæmorrhage announces itself, as a rule, without symptoms. The patient is pursuing his ordinary avocation when he is *suddenly*, without warning, *stricken down*. In a few cases there may be premonitions—headache, vertigo, neuralgic pains. Premonitions occur more frequently in connection with kidney disease, and have been, in the history of the individual, frequently present before. Sometimes the attack occurs in sleep.

It occurs frequently in the bath. It may be directly provoked by emotion, or a strain, as at stool. In certain cases there is felt a sensation of numbness, lameness, in an arm or leg. Sometimes the patient rises to fall unconscious; or is able to go about, to reach home and go to bed, and send for a physician before the lapse into coma. These cases have been denominated "ingravescent" apoplexy. Certain cases are preceded by violent pain in the head. The first signs may precede the coma by several days. These varying conditions may be explained by the quantity and rapidity of the hæmorrhage. More frequently the patient is found *unconscious*, totally *paralyzed*, bereft of sensation, in whatever position he may have fallen, in a state of profound coma. The face may be flushed, dark or pallid, or cyanotic; sometimes it is covered with sweat, which must be constantly mopped away. The surface may be cold or hot. The pulse may be full and bounding—this is especially the case in kidney disease; or feeble and fluttering, as after a profound shock. The pupils may be dilated or contracted; they are most frequently dilated, especially in profuse or ventricular hæmorrhage; they may be contracted to the size of a pin's head, especially in hæmorrhage in the pons; they may be unequal—but whether dilated, contracted, or unequal, they are always irresponsive to light.

Respiration is stertorous; the patient snores. The cheeks flap. The alæ nasi may be sucked in by inspiration. The lips are blown out with expiration. Respiration is usually retarded; its rhythm is often irregular; it sometimes stops and is resumed with a series of more rapid acts, preceded by one longer-drawn inspiration—the Cheyne-Stokes respiration. The limbs, lifted from the body, fall like dead weights. The discharges may be voided involuntarily and unconsciously; more often they are retained and must be voided artificially.

The coma and paralysis may last for several hours, the greater part of a day, or several days. During this period the patient is unconscious of everything about him. The sound of a familiar voice, as of a wife or child, may excite a responsive groan or mutter. The patient may be able to swallow. Deglutition is usually impossible at first, and imperfect for some time. Gradually there is dawn of consciousness. The sound side moves. Deglutition is less difficult. Speech is, if possible, thick. Now it is seen that one side of the body—the side opposite the lesion—is paralyzed. There is *hemiplegia*. The paralyzed side is to all appearance normal; it is usually somewhat cooler, may sweat more easily and profusely, but it is totally bereft of motion and sensation. Sensation returns in the course of a few hours or days, but motion is lost. During the existence of coma, and in the presence of universal paralysis, it may have been impossible to local-

ize the lesion. Sometimes, however, the eyes are turned in the same direction. They both look to the right or left as far as may be, but always, or very nearly always, toward the lesion in the brain and away from the paralyzed side of the body. This "conjugated deviation of the eyes" indicates lesion of the gyrus angularis with spastic contraction, which is itself a bad sign. Sometimes the head also is twisted over in the direction toward which the eyes look. It may be brought back to the median line with some degree of force, sometimes with manifest expression of pain; but, left alone, it returns

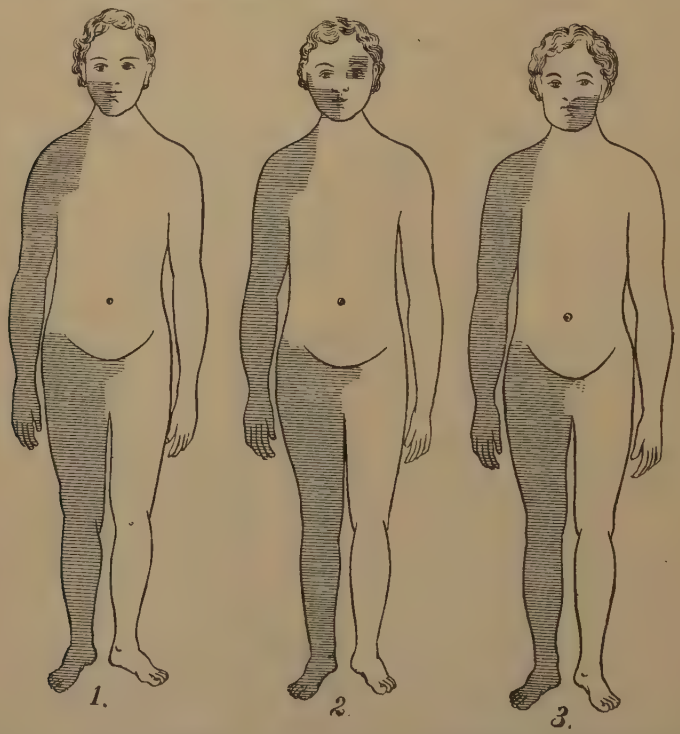


FIG. 290.—Forms of hemiplegia: 1, common type of hemiplegia, from hæmorrhage in the neighborhood of the corpus striatum—the shaded parts indicate the distribution of the paralysis; 2, hemiplegia in lesions of the crus cerebri; 3, hemiplegia in lesions low down in pons Varolii (Shaw).

as before. So the eyes may be made to follow a light to the median line, but not beyond, when they, too, assume the former direction. The paralyzed side may show, instead of less, more motion, to constitute actual *rigidity*. The hand is found clenched and flexed upon the forearm, the forearm upon the arm. Less frequently the foot is extended and inverted. This rigidity may come on early during the coma, or within a few days after the stroke, or later after the lapse of two or three weeks. Whether the rigidity be early

or late, it constitutes always a bad sign. Early rigidity speaks against recovery with life, late rigidity against recovery of use of the limb.

Diagnosis.—Hæmorrhage may at times be differentiated from embolus by the fact that embolus occurs more particularly in adolescence and maturity, and in consequence of rheumatism or some infection which has produced a lesion of the heart. The heart may be found enlarged in its diameters, and changes may be audible in its sounds. Otherwise hæmorrhage and embolus may not be separated. Thrombus occurs more particularly in gout, renal cirrhosis, and syphilis, which conditions may be recognized by evidences of these diseases elsewhere. Uræmia occurs in connection with kidney disease, which may have been plain in the previous history. Albuminuria may be recognized by the withdrawal of urine at the time of examination. Uræmia distinguishes itself by the predominance of convulsions over comatose states. Alcoholism may be recognized by the history of the individual, by the odor of the breath, by the proximity of vomited matter. Great caution must be exercised concerning these things. Mortifying reflections have been cast upon medical men who have carelessly permitted patients with organic lesion of the brain to be carried to station houses as "dead-drunk." It must be remembered that drunkards are especially liable to cerebral hæmorrhage and uræmic attacks. A man in coma should always be sent to a hospital until his true condition may be ascertained. Trauma may be discovered by examination of the skull, or may reveal itself later in the history of the case.

Time alone may accurately determine the *prognosis*. Most patients succumb to the first stroke. Coma which lasts longer than forty-eight hours is usually fatal. The immediate danger is best recognized by means of the thermometer. There is time to make observations, as death, though it may occur quickly, is never immediate as in heart disease. In the initial shock the temperature falls one or two degrees. The lower it falls the worse is the outlook. It should begin to rise in the reaction in the course of a few hours, and remain about 100° or 101° for a few days. The more rapidly it approaches the normal grade the better is the outlook. The duration of life in these cases may be most accurately determined by the thermometer. Temperature which rises from a level of 100°–102°, where it has stayed for several days, to 105° or 106°, is pre-agonal.

What damage will be left may be determined only by time. After a single stroke individuals have remained free for twenty years, long enough to have died of extreme old age. There is, however, constant liability to another stroke The sword of Damocles literally hangs over the head of an individual who has once suffered

a cerebral hæmorrhage. When the patient recovers, the leg recovers first, but long after the patient may go about on foot the arm still swings helpless at the side. In general, left-sided hemiplegias are worse than right.

Treatment.—A patient affected with apoplexy should be placed in a recumbent posture, the clothes loosened about the neck and body, the body kept warm, and the head cool by cold water or an ice bag. Stertor, which often depends upon prolapse of the tongue and occlusion of the glottis with reflux of saliva, may be usually largely relieved by placing the patient upon the right side, in such a position that the saliva may drain away (Bowles).

To bleed, or not to bleed—that is the question. Venesection was formerly unanimously employed in case of high arterial tension. A flushed face and bounding pulse were said to call imperatively for the letting of blood. This condition meets its explanation in our day better by the state of the kidneys, which causes the whole mischief in the heart and brain. It is questionable if blood-letting be ever justifiable in a case of hæmorrhage in the brain. A meningeal hæmorrhage may be relieved by surgery. No drug can dissolve blood clots in the brain.

After the subsidence of acute symptoms, muscles may be kept from wasting by massage and faradization, which best substitute absent or failing nerve force. Warm baths always give great comfort. States of irritation may be allayed by the bromides, gr. xxx. in half a glass of water. Sleep is best secured by trional, gr. xv.-xx. in a cup of hot tea at bedtime. Still later on some benefit may be derived by the subcutaneous injection of strychnia, preferably the nitrate, given in dose of one-one-hundredth of a grain, with the dosage gradually increased to tolerance. Phosphorus, the compound syrup of the hypophosphites, may be given with it. Peace of mind, when possible, is a great help. The panorama of travel may divert the mind from its own organ.

EPILEPSY.

Epilepsy (ἐπιλαμβάνω, to seize).—A fine cortical lesion, characterized by paroxysms of loss of consciousness and convulsions (momentary tonic and subsequent clonic convulsions) of the whole body, with, as a rule, dilatation of the pupils, which are irresponsive to light, and general loss of the reflexes. A subvariety marked by localized convulsions, unattended with loss of consciousness, is distinguished as Jacksonian epilepsy. Other states simulating, but differing in essential particulars, are called epileptoid, in distinction from the true disease. Explosions due to organic disease are called symptomatic; they do not fall under the head of true epilepsy.

History.—Epilepsy was known in the most remote antiquity, when it was distinguished, on account of its dreadful aspect, as the sacred disease of supernatural origin. Hippocrates wrote an entire book "De Morbo Sacro," and described it, on account of its frequency in youth, as a child's disease. The term epilepsy was not used by Hippocrates or Galen, but was first employed in the tenth century by Avicenna. Aretæus and Cœlius Aurelianus vividly described its symptomatology. Morgagni made the first attempt to discover its anatomical basis. Tissot (1770) wrote the first elaborate monograph. Esquirol, Calmeil, thoroughly described the disease. Delasiauve (1852) and Schröder van der Kolk (1858) again studied its pathological anatomy. Brown-Séquard, in his experiments in the production of the disease in animals, produced the disease by traumata. Jackson eliminated a special form. Ferrier and Horsley recommended and practised the exsection of cortical substance of the brain in treatment.

Etiology.—Epilepsy is a chronic affection which consists of an underlying condition and characteristic paroxysmal explosions of very short duration, with varying intervals of complete absence. The underlying condition is induced by various causes: 1. *Heredity* in one-third of the cases, wherein the disease may alternate with other neuroses. Thus insanity, hysteria, alcoholism, migraine, may appear in the posterity as epilepsy. In one case recorded by Gowers fourteen members of a family were epileptic in the course of four generations. Hereditary forms occur before twenty. 2. *Age;* three-fourths of all cases begin before twenty, one-half between ten and twenty, one-eighth under three years of age. 3. *Sex;* females are rather more frequently affected, in the proportion of six to five. 4. *Trauma.* Epilepsy may be acquired by injury of peripheral nerves, by disease of internal organs, especially the brain. Proof of the acquisition of the disease by injury was furnished in the experiments of Brown-Séquard, especially with guinea-pigs. In these animals blows upon the head produce convulsions, which subside to leave the animal in apparent health. Certain regions of the surface of the body now become so sensitive as, when irritated, to produce epileptiform convulsions. The cheek and front of the neck—region of distribution of the trigeminus and occipital nerves—constitute these so-called epileptogenous zones. The curious fact was now observed that the progeny of these artificially epileptic animals inherit the disease. When both parents had been made epileptic, no one of the young escaped. 5. Epilepsy may also be excited directly by *disease of the brain and spinal cord,* in which are situated certain centres, the excitation of which produces convulsions, and, through the vasomotors, spasmodic occlusion of the arteries, especially of the brain.

6. Epilepsy may be excited by gross *irritation of the cortical substance.* These cases are distinguished by forcible movement of a particular member innervated from the seat of irritation. A more extensive irritation involves also the opposite side, or more extensive groups of muscles, or the whole body. 7. Chemical poisons, alcohol, especially absinthe, urea, toxines (eclampsia), etc., produce epileptic or epileptiform attacks.

True epilepsy, however, requires the exclusion of all discoverable organic disease or chemical poison. Epilepsy, as a neurosis, so-called, *i.e.*, a disease without discoverable lesion, is assumed to depend upon discharging lesions from cortical centres rendered instable of nerve force by heredity or acquisition. This instability or irritability of nerve cells or centres constitutes the underlying condition, which may be definitely determined in about one-third of cases.

The immediate explosion is produced by some exciting cause. Infantile cases are generally due to *rickets.* They are usually ascribed to dentition, defect or delay in which is chiefly caused by rickets. In very early life *fright* is a frequent cause, but the fright is often overlooked or forgotten because of the long interval which may follow. Where the fit follows the fright immediately it is hysterical rather than epileptic. The first outbreak may be caused by some *infectious disease,* especially by scarlet fever with and without nephritis, more rarely measles, and still more rarely by typhoid fever. Cases which develop later in life may owe their origin to poisoning by alcohol, tobacco, or other excess or dissipation. Syphilis is a frequent cause of symptomatic epilepsy. Any one of these exciting causes may suffice to produce epilepsy in the presence of the underlying state.

Epilepsy shows itself in two distinct forms, as major and minor attacks, the so-called *grand* and *petit mal.* In the major, which constitutes the common form of the disease, the attack is usually preceded by a distinct sensation known as the *aura.* The aura was described by Galen as a cool breath or breeze which started in the extremity and travelled to the brain, where it produced the loss of consciousness and convulsions. Such an aura is present in only the minority of cases. But some peculiar sensation or impression, as affecting the sensitive, vaso-motor, or motor nerves, the special senses, or the mind itself, is observed in at least half of all the cases. The *sensitive aura* may show itself as a paræsthesia. pain, or anæsthesia in some part of the body, especially the extremities, the toe, the thumb, the epigastrium, whence it travels rapidly to the head or heart. The *vaso-motor aura* is distinguished as a flushing or pallor or mottling of the face or other part of the surface. The *motor aura* shows itself in twitching motions of individual muscles or groups of

muscles, grimaces, sudden spasms of the extremities, contortions of the head, trunk, circular movements, stoppages of speech, etc. The *aura of special sense* concerns especially sight and hearing, as flashes, sparks of light, sudden darkness, display of colors, especially of red, or noises, a roll of thunder, rumble of wagons, tinnitus, sounds of voices, etc. Hallucinations may be thus produced. Sauvages saw a woman to whom everything was magnified; a physician's watch was a cartwheel, etc. Per contra, Hammond saw a case in which for a certain period everything was reduced in size. Auræ of smell and taste are much more infrequent, as is also *psychical aura*, which shows itself as a sudden confusion, incapacity, or excitement.

Neither the absence nor the presence of the aura absolutely indicates an attack. In at least half the cases all aura is absent. *The absence of aura in these cases may be attributed to the suddenness of the stroke.* There is no time for the perception of an aura, which would require at least the fraction of a second. Interesting are those cases in which an aura may be intercepted or cut off and an explosion prevented. Thus a boy carried a string in his pocket, with which, by quickly winding it about his thumb, he could often prevent an attack. The swallowing of a handful of salt may intercept a stomach aura in the same way. Firm pressure upon a particular part of the body, as against a mantelpiece or piece of furniture, may have the same result. Subsequent attack after such interruption is wont to be more severe.

Symptoms.—The attack proper occurs like a seizure, suddenly. The patient, in whatever situation or position, sinks unconscious to the ground. The fall may be attended or preceded by *a cry*, a peculiar, indescribable groan, of which the patient is unaware, though it is said that he sometimes hears and remembers it. The epileptic cry is a mechanical expression of air from the chest through a spasmodically contracted glottis; but, with or without the cry, the patient falls as if stricken by lightning, falls precipitately, and, from preponderance of weight, usually forward upon the face. There is total *abolition of every sense and sensation*, hence damage is often inflicted by the fall itself. Patients have been drowned in a tub of water, or more frequently burned by fall into a fire, until the face, feet, or other part of the body have become charred. At the moment of the stroke the face is blanched from spasmodic closure of the arteries. Delasiauve had the opportunity to see during an ophthalmoscopic examination the same blanching of the retina at the moment of attack. In this moment of pallor the *whole body is rigid.* There is for a few seconds a complete tonic, tetanic spasm. The breath stops, the heart's action is arrested.

Almost at once the scene changes. The face flushes, the color deepens sometimes to the deepest cyanosis, the vessels stand out in the neck, the eyes protrude, as Aretæus said, like those of a strangulated bull, and *convulsions*, more or less violent, agitate the entire body. The convulsions distinguish themselves by their tumultuous character. The head is tossed from side to side, the eyes roll in their orbits; the tongue is protruded and withdrawn; it is often caught and cut between the teeth, so that the saliva, churned into foam, is tinged with blood and oozes out, thus colored, upon the face. The discharges may be voided unconsciously. The pupils are usually dilated, sometimes contracted; they are always irresponsive; with returning consciousness they may show for several minutes alternate contraction and dilatation every few seconds. As the convulsions progress

FIG. 291.—Epilepsy; period of tonic convulsion (Mercier).

the body becomes covered with sweat. Gradually, in the course of a few minutes, though the time seems much longer to spectators, the convulsions grow weaker, while the loss of consciousness still persists. With the entire subsidence of the convulsions some degree of consciousness returns. The patient, dull and exhausted, may fall into deep sleep, from which he awakens *without the slightest recollection of the attack.*

There is every variety in the frequency of recurrence. Attacks may occur only at intervals of years. The first attacks are, as a rule, the furthest apart; subsequent attacks have shorter intervals. Attacks may occur daily or may be repeated several times a day. Such frequency of attack is usually due to organic disease.

Epilepsia minor, *petit mal*, shows itself in much greater variety of form. A common expression is a very temporary arrest or

obscurity of consciousness with preservation of automatic control. The attack may consist of a staggering step or two upon the street; of a fall of the hand in writing, to leave a scrawl upon the page; of a momentary vacant stare or gaze into vacancy; of a sudden falling asleep with the eyes open (narcolepsy); of a sensation of faintness or vertigo, with twitchings or convulsions of individual muscles or groups of muscles in the face, trunk, or extremities; or the various disturbances which have been described among the auræ. Among these conditions are curious psychical disturbances. A patient under the observation of the author left his bed in the hospital, ran up the track of an inclined plane in the vicinity, jumped from a great height to the street below, and was brought back in a mangled state. In these states of minor epilepsy crimes may be committed—suicide, homicide—without motive and without remorse. Strange dual mental states occur. Patients have left home and have been found in distant cities or countries, travelling meanwhile without mishap. Eccentricities are not infrequent. Incongruities, even indecencies, may be committed. The patient may pass water or prepare in public for the act of defecation, etc. Between epilepsy and insanity, between neurosis and psychosis, it may be impossible to draw the line. The disease of the brain may be the cause of both. Especially characteristic of epilepsy are dulness with poverty of speech, defects of memory, acts of cruelty. These states may occur also after the major attacks in the condition of stupor, where the mind is still hazy; and periods of maniacal excitement in which patients become dangerous are not infrequent, so that proof of the existence of epilepsy often suffices in a court of law to secure exemption from punishment for crime, on the ground of irresponsibility. The door is open here for much miscarriage of justice. The performance of definite acts with the loss of regard of consequences is ascribed to the fact that the intellectual centres are held in abeyance, while the lower automatic centres continue to act. Thus an architect has been known to walk a scaffolding or gutter at great height without losing balance; a cabman to drive his vehicle through crowded streets without accident. Mishaps may occur in these procedures. Patients thus affected are liable to pocket things which do not belong to them. Gowers speaks of a patient who mistook a dinner table, on another occasion the shelves of a cupboard, for a staircase.

Mental degeneration occurs also in certain cases in the interparoxysmal state, sometimes as loss of memory or control, restlessness, irritability, and perverted *morale*. The intellect is usually unaffected at first, but becomes dull and blunted with successive attacks, and with rapidity of degradation in correspondence with the

frequency and severity of attacks, so that, while in exceptional cases epileptics have been distinguished for mental vigor, they drift often into dulness and end in imbecility. It may be offered as a consolation to patients that epilepsy may exist for years or for life, with attacks frequent and severe, and yet leave the intellect unimpaired. It may be repeated that epilepsy and psychosis may have independent as well as common origin, and that the psychosis need not be a necessary effect of the epilepsy. Most of the cases of genius said to have been affected with epilepsy (Mahomet, Napoleon, etc.) were probably only cases of aggravated hysteria.

Diagnosis.—In marked forms epilepsy may not be mistaken. The aura; the cry; the stroke with its loss of consciousness and total abolition of motion and sensation; the subsequent convulsions, which cease in the course of a few minutes, to leave the patient drowsy and dull; with the complete interval, sufficiently distinguish the disease. Enuresis nocturna, ecchymoses of the conjunctivæ, morning headache or heaviness, may indicate nocturnal attacks. Lighter cases of petit mal are often overlooked. They may be usually recognized by the arrest of consciousness with the subsequent mental dulness, by the existence in certain cases of an aura, and by the condition of the interval. The diagnosis may be difficult in childhood, where reflex convulsions are frequent. Time only may clear up certain cases. Hysteria may closely simulate epilepsy. The age and sex of the patient may be distinguishing points. Epilepsy occurs first most frequently in childhood; hysteria, first at puberty. The attack of epilepsy occurs without apparent cause, while hysteria supervenes upon some emotional disturbance. The various auræ of epilepsy all differ materially from the mental disturbances, palpitation, choking sensations, which announce the advent of an attack of hysteria. Epilepsy begins suddenly, hysteria gradually. The attack in epilepsy is often preceded by a cry, which occurs but once; hysterical patients may cry out more or less continuously during an attack. The spasms of epilepsy differ from the struggles of hysteria; they are wholly involuntary, irregular, and of very short duration. The movements of hysteria are more purposive, more careful of injury or exposure. Opisthotonos may be more or less persistent in hysteria, and the convulsions in general are of much longer duration. Involuntary discharges, frequent in epilepsy, never occur in hysteria. Loss of the reflexes in the height of the attack is proof of epilepsy, but presence of the reflexes does not entirely exclude it. Organic disease of the brain (syphilis), uræmia, etc., are separated by other signs of these conditions.

The *prognosis* regarding life is favorable, regarding recovery is unfavorable. The patient may die in a fit. Death occurs more fre-

quently from accident. The disease has no tendency to spontaneous termination. Individual cases may recover. The chances of recovery become less with advancing age. Recovery is not uncommon in childhood, but is rare after puberty.

Treatment.—Every case of epilepsy must be studied. Sources of reflex origin are to be removed. Attention here must be directed especially to affections of the stomach and uterus. Irritating cicatrices may be excised. Scrupulous attention must be paid to the habits of life. Excesses with food, alcohol, must be corrected. Address must be had to the underlying state. Treatment is directed to the relief of the attack and prevention of the convulsions. During the convulsions the patient should be let alone. Only so much restraint should be used as to prevent accident from fracture of bone or dislocation of joints. A cork, knife handle, may be inserted between the teeth to prevent mutilation of the tongue. Clothing should be loosened about the body. Attempts to cut the attack short with anæsthetics are useless. The subsequent condition of the patient is better after a full explosion of the disease.

In the treatment of the disease proper two remedies assume prominence, the bromides and atropia. The bromides are best administered largely diluted, and in dose and frequency of repetition according to the age of the patient and frequency and severity of the disease. Of the various preparations the bromide of potassium is the most effective. The remedy is administered in dose varying from fifteen to forty grains once or twice a day, preferably in a glass of soda water night and morning, increasing up to tolerance. Its efficacy may be heightened by administration with some bitter infusion, as the infusion of absinthe ʒ ij.–iv. per dose. Acne is best avoided by the use of arsenic, liquor potassæ arsenitis, gtt. ij.–v. with each dose of the bromide, and by frequent washing with soap. As a rule the patients do the best who show the least acne. The general rule in treatment is to ascertain the smallest dose necessary to prevent the attacks, and cut the quantity down. The administration of such quantities as produce mental dulness and drowsiness is unjustifiable except in the most extreme cases. Each case must be studied also in this regard. Attacks which are persistent under small, have yielded under large, doses. The remedy must be used with regularity for months, sometimes for years. Atropia, solution gr. i.–ʒ i., is given in dose of gtt. ij.–v. three or four times a day or up to tolerance; then the quantity is to be reduced and kept within these limits. Atropia addresses itself to the underlying state. Borax may be tried next, beginning with a small dose, gr. v.–xv., and increasing, in the absence of gastro-intestinal irritation,

to 3 i.–iss. Borax is best administered with glycerin and syrup of orange peel; thus:

℞ Sodii boracis ..... 3 ij.
Glycerinæ ..... 3 ij.
Syrupi auiantii corticis ..... ℥ i.
Salep ..... ℥ iij.
M. S. Begin with tablespoonful doses.

Should these remedies fail, resort may be had next to zinc, which is best given in the form of the lactate in dose of ten to fifteen grains three times a day. With the failure of all these means the practitioner may experiment with a host of remedies recommended in the materia medica. Cases uncontrolled by the bromides or atropia are usually unamenable to relief. The knife of the surgeon is a *dernier ressort*, justified only in cases of threatening degradation of the mind. Thus far the results are discouraging.

TUMOR OF THE BRAIN.

Tumor of the brain is a growth which, springing from the envelopes or arising in the substance of the brain, produces a train of symptoms according to its situation, character, and extent; most frequently intense headache, amblyopia or amaurosis, choked disc, vertigo, vomiting, convulsions, paralysis of various cerebral nerves successively, with or without disturbance of the intellect.

Fig. 292.—Tubercular tumor of middle lobe of cerebellum (Gowers).

The construction and composition of tumors vary greatly. *Tuberculosis* and *syphilis* are most frequent causes. These growths spring from the bones or membranes, or develop in the substance of the brain. Next ranks *glioma* (γλία, glue), a whitish or more or less vascular growth, hard or soft in consistence, according to the amount of connective tissue, varying in size from a cherry to a fist, and situated most frequently in the cerebral hemispheres. Gliomata are distinguished, from their composition or combination, as angiectatic, myxomatous, and sarcomatous, composed respectively of highly vascular tissue with tortuous vessels, or of mucous tissue, or abundant cells and sparse connective tissue. Gliomata are also distinguished by slow growth, liability to hæmorrhage, with occasional tendency to fatty degeneration and atrophy. Next in the order of frequency is the *sarcoma*, which is again distinguished as the angiosarcoma and myxoma or angio-myxo-sarcoma. Primary *carci-*

noma is rare; secondary (metastatic) is more frequent. Peculiar growths, which result from the aggregation of numerous minute, irregular, shining masses like mother-of-pearl, constitute the *cholesteatoma*, which arises from degenerated epidermic cells arranged concentrically about a nucleus. More infrequent is the angioma, composed almost entirely of vessels. Still rarer are the *fibroma*, *enchondroma*, *lipoma*, and *osteoma*, terms which indicate the character of the growths. Inasmuch as the symptoms of brain tumor are wholly due to pressure, distention of vessels and *aneurism* of the cerebral arteries must be included under this head. The arteries most frequently affected are the basilar and middle cerebral, the left more frequently than the right. Among the *parasites* which form growths in the brain are the cysticercus and the echinococcus.

Etiology.—Certain tumors, the angioma, cholesteatoma, and glioma, possibly also fibroma, enchondroma, and lipoma, may be

FIG. 293.—Gliomata of left hemisphere; asterisk marks site of subcortical growth (Gowers).

congenital, or at least arise at birth and develop later. Cohnheim believed that many cases are survivals from fœtal life. Childhood offers the largest contingent of cases; after childhood, the age from thirty to sixty; males more frequently than females, in the proportion of 3 : 2. This disproportion exists not only with reference to syphilis, but to all tumors. Blows upon the head may develop changes which are not confined to the bones and membranes, but concern also the interior of the brain. This fact, with the more frequent abuse of alcohol, accounts for the more frequent affection of the male sex.

Symptoms.—The symptoms of brain tumor are general and local. They vary according to the seat rather than the character of the lesion, rapidity of growth, etc. Symptoms are immediate and remote, according as they result from direct or indirect pressure. Tumors in silent regions, as in the hemisphere of either cerebrum

or cerebellum, may show no symptoms. So tumors, unsuspected in life, have been discovered on autopsy. Small size, slow growth, may account for lack of symptoms. Increase in size naturally displaces fluids or blocks vessels, to lead to the accumulation of fluids which constitute hydrops in the ventricle, and to lead to the accumulation of cerebro-spinal fluid in the sheath of the optic nerve. Softening about the tumor develops symptoms of irritation. The most frequent of the general symptoms are *early fatigue*, associated often with depression or *melancholy*, in use of the brain, whether for mental or physical labor. The most constant sign is *headache*, intense and persistent. It is felt especially in the region of the forehead, temples, and occiput, though the situation of the pain does not necessarily localize the tumor. The headache is often associated with *vertigo and vomiting*—cerebral vomiting, which occurs without nausea and without reference to food. In the midst of symptoms of apparently trivial character *convulsions* may suddenly supervene. They are epileptiform in type, from anæmia the result of reflex spasm of the cerebral arteries. *Dulness, stupor, retardation of pulse and respiration*, are evidences of direct pressure upon the brain. Along with these symptoms there shows itself, as a rule, the *choked disc* on both sides; its early occurrence makes it a symptom of much value. In these cases the swollen papilla becomes opaque; its surface is traversed with dilated arterioles and tortuous veins. It is, however, not pathognomonic; neither the presence nor absence of it defines or excludes the disease.

The tumor acts directly or indirectly in *pressure upon individual nerves*, or a mass of brain substance to cause hemiplegia. The situation of the growth determines the affection of the particular nerves. The most frequently affected are the olfactory, optic, abducens, and oculo-motor. The facial is usually involved in all its branches—a point of value in differential diagnosis. The trigeminal is affected, as a rule, only, or most, in the sensitive branches. The hypoglossus, in its narrow bed, is involved on both sides. Hemiplegia is sometimes crossed. Electric excitability in the affected muscles is usually at first increased and later reduced. The reaction of degeneration is rare. Paresis and paralysis are much more common than pains and paræsthesiæ, as pressure destroys rather than irritates. Tumors in the *anterior fossa* affect especially the olfactory and optic, the first branch of the trigeminus, and the oculo-motor nerves. Tumors in the *middle fossa* affect the optic, oculo-motor, and oblique, the abducens and trigeminus. By indirect pressure they may produce hemiplegia. Tumors in the *posterior fossa* affect the trigeminus, facial, auditory, glosso-pharyngeal, pneumogastric, and spinal accessory. There may be in these

cases tinnitus aurium from irritation of the auditory nerve ; vomiting and retardation of the pulse from irritation of the pneumogastric nerve ; amblyopia from pressure of fluid accumulated in the ventricles. Tumors in the *hemispheres* of the cerebrum show *local convulsions*, monoplegias or hemiplegias, with anæsthesia and contractions, amblyopia, aphasia, etc. Tumors of the *cerebellum* are recognized chiefly by the *reeling gait, amblyopia, affection of hearing and smell, occipital headache*, etc.

The *diagnosis* rests chiefly upon the tripod, headache, convulsions, and choked disc. It is further established by vertigo and vomiting, retardation of pulse and circulation, successive involvement of cerebral nerves, hemiplegia, etc.

Treatment.—Therapy has reference only to tumors of syphilitic origin. Every case should have the benefit of doubt and be subjected to radical treatment with mercury and iodine. The most intense and dangerous symptoms sometimes disappear as by magic under the use of the iodides. Large doses are best administered in milk, and are most thoroughly conveyed through the body with the additional use of mineral waters in quantity. The effect of mercury is best secured by inunction. Most frequently the relief which is secured is partial and not complete. It must be remembered that, though the tumor be dissolved away to leave no trace, irreparable damage to the brain has often been done. Other treatment is wholly symptomatic. The bromides sometimes suffice to hold headaches under entire control. Chloral may relieve insomnia or convulsive manifestations, etc. Surgery scores triumphs in this field of medicine.

ABSCESS OF THE BRAIN.

Suppuration may occur in any part of the brain substance. It is most frequent in the cerebrum, next in the cerebellum, and is rare in the basal ganglia, the pons and medulla. The temporo-sphenoidal lobe suffers most, because of proximity to the ear, disease of which is the most frequent cause of abscess. The abscess is single in four-fifths of cases.

Etiology.—The cause of brain abscess may be local or general. Nearly three-fourths of cases of abscess of the brain are produced by local causes : nearly one-half by diseases of the ear, one-fourth by injury. Other local causes are diseases of the nose and caries of bones of the skull. The general causes are for the most part metastases of pyæmia of distant origin. Abscess of the brain occurs at all periods of life, but is most frequent in males, in the proportion of three to one.

Morbid Anatomy.—Brain abscesses vary in size from a walnut

to a fist. They are encapsulated in about one-half of the cases. The pus is often greenish, and is sometimes fetid. Metastatic abscesses are minute and multiple. Abscesses from ear disease and injury may occupy a large part of a hemisphere. An abscess may burst into the ventricles, or may discharge upon the surface of the brain to produce meningitis.

The *symptoms* may be latent. Cases have been reported where abscesses as large as a fist, without sign of disease in life, have been discovered upon autopsy. Abscesses in the frontal and temporo-sphenoidal lobes seldom show signs at first. This is true also of abscesses in the great ganglia at the base. Tolerance is established in abscesses of slow growth. Again, the disease may be overshadowed by the symptoms of its cause—*e.g.*, disease of the ear, trauma, pyæmia. Pyæmia often shows itself with such periodicity of fever and sweat as to be mistaken for malaria. The typhoid form of pyæmia masks the evidence of brain abscess. Of local signs the most common is *headache*, the situation of which corresponds to the seat of the disease more frequently than in tumor. Epileptiform *convulsions* are not infrequent. *Paralysis* develops in correspondence with the site of the abscess, but shows itself usually in the form of a hemiplegia. Paralysis in the course of, or in connection with, convulsions indicates abscess more frequently than any other condition. Monoplegias are not common. The most frequent monoplegia is ptosis. The facial and auditory nerves are affected through the caries of ear disease. Optic neuritis, *choked disc*, occurs, but is not so frequent as in tumor. *Vertigo and vomiting*, with staggering gait, indicate localization in the cerebellum. Dulness, drowsiness, stupor, with progressive wreck of the mental faculties, belong among the later symptoms. Patients usually succumb to coma.

The *diagnosis* rests especially upon the connection with the cause. Evidences of ear disease, trauma, or pyæmia may be found in three-fourths of cases. It must be remembered that abscess of the brain occurs in the distant course of chronic ear disease. Tumor, a far more frequent disease of the brain, develops more slowly and advances by progressive paralysis of cranial nerves, and with more frequent and intense optic neuritis.

The *prognosis* is always grave, but the danger is less immediate in cases where the abscess develops slowly and becomes encapsulated. Gowers reports cases of abscesses, with calcified walls and inspissated contents, latent or quiescent for twenty years.

Treatment.—The main consideration is prophylaxis, which includes especially patient and persistent treatment of ear disease, with general asepsis in all cases of trauma, etc. The treatment proper is the evacuation of the abscess under the trephine, which the modern

methods of localization enable the surgeon to accomplish. Unfortunately final recovery is rare, even with the help of the knife.

LOCALIZATION OF LESIONS.

Lesions are localized in the brain by the parts of the body affected with symptoms. Though the conclusions are still indefinite, and the facts of most value to the physiologist and the surgeon, the discovery of motor centres in the brain marks an epoch in the history of nervous diseases. The pioneers in this field were Hughlings Jackson, who contributed his observations from the standpoint of clinical medicine, and Broca, who based his observations upon autopsies. Experimental investigations followed later by Fritsch and Hitzig, and Ferrier and Horsley.

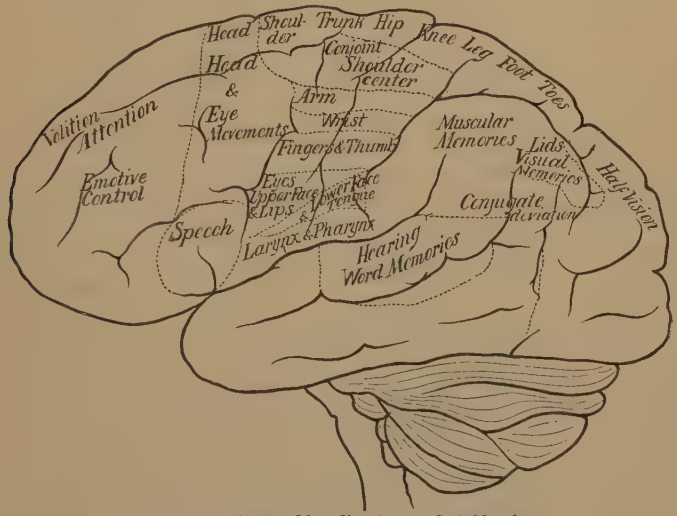


Fig. 294.—Cerebral localizations. Outside view.

Lesions are divided into irritative and destructive. Irritative lesions produce spasm and paræsthesia; destructive lesions produce paralysis and anæsthesia. The field of localization in the brain lies in the central convolutions and the paracentral lobule. The cortical centres of the hypoglossal and facial nerves, where the coarse motor impulses are multiplied or reduced to finer movements, lie in the lower third of the anterior central convolution. The centre for the arm lies in the middle third of the anterior and part of the posterior central convolution. The centre for the leg lies in the upper two-thirds of the posterior, upper third of the anterior convolution, and the paracentral lobule. The centres of speech are situated in the frontal lobes, chiefly of the left hemisphere, lesions of which pro-

duce aphasia (*α*, priv., *φάσις*, speech). Lesion of the third frontal convolution produces ataxic (*α*, priv., *τάξις*, order), lesion of the first temporal convolution produces amnesic (*α*, priv., *μνῆσις*, memory), aphasia. More extensive lesions of these centres produce agraphia, inability to write, and alexia, inability to read. But anarthria, a condition in which the patient is not aphasic at all, but is unable to form words or forms them badly, depends upon, and is a most valuable sign of, lesion of the pons. Lesion of the parietal lobe affects the muscular sense, so that the patient without the aid of vision loses equilibrium. Lesion of the lower portion of the parietal lobe affects the conjugated movement of the eyes—that is, irritation intensifies the movement and directs the eyes to the seat of lesion, while destruction paralyzes it and permits the eyes to rotate in the opposite direction. Lesion of the occipital cortex produces hemianopsia. Disease or injury of the internal capsule in its middle portion affects the mus-

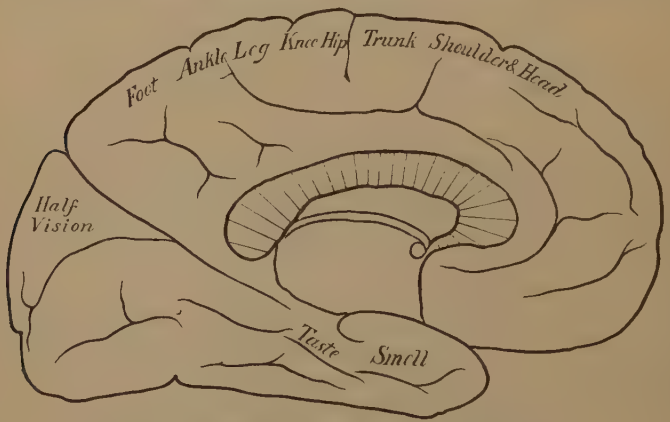


FIG. 235.—Localizations in the cerebrum. Inside view.

cles of the face and extremities; disease of the posterior portion affects sensation and produces complete hemianæsthesia. Disease of the crura cerebelli produces irritation or paralysis, that is, spastic contraction or hemiplegia upon the opposite side, and affects the oculo-motor upon the same side, of the body. Disease of the pons usually produces crossed paralysis of the body and face—that is, of the opposite side of the body and same side of the face. When the disease is exceptionally situated in the upper (cerebral) half of the pons, above the decussation of the facial fibres, the face is paralyzed on the same side as the body. Disease of the corpora quadrigemina produces irritation or paralysis of the muscles of the eye. Affection of the anterior pair is distinguished by loss of sight and paralysis of the pupils; of the posterior pair, by paralysis of the oculo-motor nerves, and often by ataxia. Disease of the crura cerebelli may be

attended by compulsory movements, especially of rotary character. Disease of the cerebellum is marked by vertigo and a staggering gait—conditions which have been observed, however, in other lesions of the brain. Progressive implication of cranial nerves indicates an encroaching lesion, tumor, abscess, etc.

HYSTERIA.

Hysteria (*ὑστέρα*, the womb).—A neurosis with symptoms on the part of the whole nervous system, distinguished especially by unstable nerve centres and loss of control of the will. The term dates from ancient times, and had its origin in the belief that the affection was due to disease of the uterus. What diseases of this organ occur in connection with hysteria are now known to be coincidences or consequences and not causes. One of the finest chapters in the history of medicine was written by Sydenham (Epistolary Dissertation 58) of this disease.

In *etiology* the most important rôle is played by sex. Ninety-five per cent of the cases are females. When it occurs in males it is most frequent in boys. The disease may show itself at any period of life from childhood to old age, but occurs with especial frequency about the period of puberty. The supreme factors in the production of the disease are *heredity and training*. The disease may be transmitted directly, or the hysteria may be the expression of an allied neurosis, insanity, epilepsy, migraine, in the ancestry. In our country the majority of cases are acquired through defects in education. The fault begins with childhood, and rests largely upon the failure to develop self-control; hence the disease is especially frequent among the upper classes, whose luxurious habits lead to indulgence and neglect. Diseases of organs, impoverishment of the blood, chlorosis, anæmia, indoor life, overstimulation at school, aggravate and precipitate attacks. Outbreaks in later life are generally due to disappointments in love affairs or domestic infelicities.

The disease shows no demonstrable lesion, for, as Sydenham said, the case may be considered hysteria only when, after the most careful examination, all evidence of disease can be excluded. So the pathology of the disease rests upon a disturbance of action or function which is supposed to be caused by imperceptible, as yet undiscoverable, molecular change.

Symptoms.—The underlying condition is the weak nervous system and the lack of self-control. The disease, as stated, shows symptoms in the whole domain of the nervous system, in which regard it is distinguished from hypochondriasis, which confines its manifestations to the *psychical sphere*. Disturbances in this sphere play a most important rôle in hysteria. Hysterical patients are so highly

irritable as to be sensitive to circumstances and influences unnoticed in health. Trifles are exaggerated. The patient yields more and more easily, until finally all resistance is surrendered. So the action of the higher centres is inhibited. The faculties of the mind revert to the uncontrolled, undeveloped, and emotional state of childhood. As Sydenham said, "all is caprice."

Affections of the *motor system* show themselves especially in the form of convulsions and paralyses. The *convulsions* occur for the most part in paroxysms, preceded by some emotional disturbance. The immediate outbreak is often preceded or attended by auræ, usually on the part of the digestive system, as a sense of oppression or distress in the region of the stomach, singultus, eructations. The patient suffers an attack of convulsions which more or less closely simulates an epileptic attack. There is rigidity which is often extreme. Opisthotonos is common and persistent. Spasmodic convulsions supervene, become universal, and are attended with the associate disturbance in circulation and breathing. The difference between the epileptic and the hysterical attack rests mainly upon the maintenance of consciousness through hysteria. The fall is not precipitate as in epilepsy. The patient is careful to select a chair or sofa in protection of the body. The tonic and clonic convulsions are more violent and much more sustained. The spasms themselves are more directly in the line of voluntary movements, and the whole attack is protracted into hours or fractions of an hour, far beyond the limits of ordinary epilepsy. During all this period, though the eyes are wholly or partly closed, the pupils are perfectly natural. Exceptional cases show a closer approximation to epilepsy, sometimes as complications—for the diseases do not concur, not even as transition stages. As the exact diagnosis is in these cases sometimes difficult or impossible, they are often grouped under the term hystero-epilepsy. They are, however, not epilepsies. They are aggravated hysterias. A subvariety of hysteria is offered also in the exaggerated choreic manifestations which constitute *chorea magna*. These cases of wildest gymnastic contortions and half-purposive movements, with the other vagaries of hysteria, trances, cataleptic states, apparent death, make of the victims objects of curiosity and wonder with the illiterate, and excite that kind of false sympathy and sentimentality which is fatal to cure.

While the convulsions of hysteria may involve any of the muscles of the body, they are wont to affect more especially certain muscles, as the muscles of the glottis to produce *spasm of the glottis*, of the pharynx to give rise to the impression of a foreign body in the throat, the so-called *globus hystericus;* and regions thus affected have often the reflex sensibility so much diminished as to

show more or less anæsthesia. So, too, any of the muscles of the body, voluntary or involuntary, may be affected with paresis or paralysis. But here, too, certain muscles are selected by preference. Paralysis of the muscles of the larynx leads to *aphonia*, of the throat to *dysphagia*, of the intestine to *meteorism and constipation*. The whole limb or half of the body may suffer the same paralysis. The paralysis usually affects the leg, and paraplegia is much more common than hemiplegia. In all cases the affection is *rather a paresis than a paralysis*. But long-continued paralyses,

FIG. 296.—Chorea magna. Rhythmical, half-purposive movements of hysteria (Dana).

often of years' duration, may finally bring about permanent lesions, atrophic changes, which show themselves in the nerve centres as well as in the muscles. A patient in the experience of the author remained confined to her chair for nineteen years, and finally made what recovery was possible under the atrophic changes which had supervened. She became able to go about with a stick and crutch. Up to the development of serious atrophic change, the reaction of degeneration is always absent in hysteria.

Some form of *disturbance of sensation* is present in every case. Hyperæsthesia is more frequent than anæsthesia, and certain sensi-

tive points assume prominence in the course of hysteria. Such "hysterogenic" spots are points about the head, as if pressed upon by some hard, pointed object, as a key, and constitute the so-called *clavus hystericus;* or in the course of the vertebral column, especially the region of the ovaries, pressure upon which sometimes calls out an explosion, or, per contra, cuts it short in its course. Irradiations from the tender points in the vertebral column constitute the so-called cases of "spinal irritation." Anæsthesia may be also irregular and slight, or diffuse and extreme. The sensation may be diminished or abolished in localized surfaces of the skin or mucous membranes, not infrequently in an entire half of the body, to constitute the *hemi-anæsthesia* which is almost peculiar to hysteria.

Fig. 297.—Hysterical contracture of right leg and foot (Charcot).

The *contractures* usually occur in connection with, or immediately subsequent to, a convulsive attack or explosion, and are most frequently located in that member or part of the body which may be the seat of pain or other distress. Concentration of attention fixes the seat of disease. Once fixed in a member, the contracture persists; and though the symptoms of the disease are distinguished by their protean character, the deformity assumed in an individual case usually remains with it for months, for years, sometimes for life. Thus the arm may be contracted in fixed flexion, and the contraction of the fingers with the included thumb simulates the late rigidity of hemiplegia. In more exceptional cases the fingers are extended to assume the position of tetany. Any attempt to release the spasm intensifies it, and increased flexion of the wrist, which loosens to some extent the rigidity of hemiplegia, only exaggerates that of hysteria. The leg, on the other hand, is fixed in extension with the heel, drawn up to bring the foot with its inverted sole and flexed toes in a straight line with the leg. In any case hysterical contractures, though of years' duration, may disappear under the influence of powerful emotion. These are the cases upon which miracles are worked, and the triumphs of the faith cure are recorded in this field. A similar spasm of the diaphragm, with relaxation of the muscles of the abdominal wall, produces, with the accumulation of gas in the intestine, that distention

of the abdomen which is known as the *phantom tumor*. Hence this tumor disappears entirely under anæsthesia.

Among *vaso-motor disturbances* may be noticed increase in the secretion of tears, saliva, sweat, which may be localized or unilateral. Even the flow of milk may be increased. *The secretion of urine is often enormous.* Such urine is, Sydenham says, "clear as water from a rock." More peculiar is the discharge of blood which may take place from the mucous membranes—that is, from the mouth, the intestine, the lungs. More incredible are the subcutaneous hæmorrhages and free discharges of blood upon the surface which constitute stigmata. Localization of these stigmata in the hands and at the ankles in states of religious ecstasy has been credibly reported. These cases, however, are usually regarded with suspicion, as most of the hæmorrhages are aided by voluntary breaks of the surface. The exact stigmata of crucifixion are always artificial, and real hæmorrhage of the lungs belongs to disease, especially to tuberculosis, which intensifies, if it does not develop, the hysteria. Pretty much all the cases of so-called vicarious menstruation belong to tuberculosis, the disease *par excellence* which disturbs the menses. Many cases of hæmorrhage, "bleeding from the lungs," are really bleedings from the gums, and blood shown in vessels has been found to have been derived from an outside source. See also chapter on Hæmorrhagic Diathesis.

Hysteria is in its nature full of *freaks*, some of which—cataleptic, clairvoyant, lethargic states, transfer of sensation from one limb to another by the application of a piece of metal—remain as yet incapable of explanation. It must be remembered that hysteria is a near neighbor to insanity, and that the explosions of the disease are states of temporary insanity. A grave complication is that excessive derangement of digestion which is shown in *obstinate vomiting and anorexia.* "Fasting girls" are nearly all hysterical. In many of these cases there may be detected an element of fraud. Hidden food is swallowed on the sly. Individual cases are real, and these cases may be always distinguished by the progressive loss of weight which necessarily ensues upon the deprivation of food. In the experience of the author a case of this kind, attended with vomiting of blood, was presented to the class as a gastric ulcer. The patient actually died of starvation, and the most careful post-mortem examination failed to disclose any lesion whatever.

Affections of the bladder are not at all infrequent, sometimes as dysuria with frequent desire of micturition, more frequently as anuria, which may last a long time, a week or ten days, without evidence of uræmia—an important point in differential diagnosis. When catheterization is actually necessary in these cases it should be done by the nurse.

The *diagnosis* rests upon the sex, age, and history of the individual, though negative testimony in any of these particulars does not necessarily exclude the disease. *The train of symptoms is too irregular to be associated with organic disease.* The influence of the emotions may be distinctly observed. Examination by the physician intensifies the symptoms. The convulsive seizure is distinguished by the preservation of consciousness, the rhythmical, half-purposive movements, the condition of the pupil, which responds to light, the long duration of the attack. The contracture and paralysis are differentiated by their associations. Paraplegia, for instance, is almost never hysterical. Affection of one vocal cord is unknown in hysteria. Hysterical paralysis of the larynx is double. It is as easy to recite rules in diagnosis as to multiply words in the description of symptoms. They are often alike vain. The most experienced practitioner, in the face of lessons which may be still fresh in the memory, is liable to be deceived by the freaks of hysteria.

Prognosis.—Hysteria is always a chronic affection. The underlying condition is born with the individual and remains lifelong. The disease may, as stated, actually take life. Death has occurred in an attack of convulsions, more frequently in cases on the border lines of epilepsy. Exceptional cases succumb to spasm of the glottis, more frequent cases to vomiting and marasmus. Individual cases recover, sometimes absolutely, more frequently incompletely with liability to relapse. Bad cases may terminate in insanity, especially in melancholia, religious fanaticism, finally in dementia. Psychoses, which supervene at the grand climacteric, have a bad prognosis.

Treatment is difficult. It is usually a matter of *morale.* In no field of medicine is interference so often meddlesome and injurious. This is especially true in the domain of gynæcology. The management of a case of hysteria calls out the tact of the physician. He must steer between sympathy and indifference. In the treatment of exaggerated cases isolation, especially with a reliable, preferably a stolid or phlegmatic nurse, is a *sine qua non.* The patient is to be fed, and the food is to be digested and absorbed. The way out is through food and sleep—*i.e.*, nutrition and rest. It is well to remember a French proverb, "*Qui dort, dine*"—who sleeps, dines. Regarding drugs, the less the better. Opiates should certainly be avoided. The convulsions of hysteria are so quickly allayed by chloral as to make the use of it a constant temptation; here, too, the less the better. Convulsions usually subside so soon as the physician is left alone in the room with the patient, who quickly learns that he understands the case. Nervous states may be relieved by the bromides, asafœtida, and valerian, but here, too, the less the

better. To treat the individual rather than the disease is the sum of therapy.

HYPOCHONDRIASIS.

Hypochondriasis (ὑπό, under, χονδρός, cartilage).—A psychosis characterized by a concentration of the mind upon the internal organs. With hysteria, it is an almost wholly psychical condition, but with an entirely different expression. Hysteria is largely a loss of control of the will; the hypochondriac may be a person of strong will. Males predominate, but there are hypochondriac females as well as hysterical males. The conditions may be associate. Hypochondriasis usually rests upon some slight disturbance in the sensory sphere, a hyperæsthesia or paræsthesia, which passes unnoticed in health, but forms the basis of an imaginary malady in this disease. The affection is located, in the great majority of cases, as the name implies, under the cartilages of the ribs, in the liver or other organ of the abdomen, and is the exaggeration of sensations caused by dyspepsia, flatulence, hæmorrhoids, etc. A slight lesion of the mucous membrane is mistaken for syphilis, and the patient is often a lifelong victim of syphilophobia. Impotence, which the patient may really induce by the fear of it, is considered a sign of organic disease of the spinal cord, locomotor ataxia, etc. Palpitation of the heart, a common expression of gastric catarrh, is regarded as a sign of heart disease which may cause sudden death at any time. Flatulence indicates the existence of a tapeworm which is consuming the vitality of the body. The fear of cholera, in the presence of an epidemic, may be so great as to make the patient sweat with anxiety and actually produce a diarrhœa. The sufferings of the hypochondriac are intensified and prolonged by perusal of medical works, or more especially of popular medical literature, which can convey only erroneous ideas. The hypochondriac delights to dwell upon his symptoms with a fellow-sufferer or with any one whose attention he can secure. He gloats over details with downcast eyes, and is finally shunned like a plague by those who know him. The confirmed hypochondriac, with his constant fear of death, and extraordinary care of himself at the expense of every one else, will wear out and survive every member of his family.

The *treatment* is an arduous task, for the disease, as in hysteria, depends often upon inherited states. The physician must not ignore and must not emphasize individual symptoms. Especial attention must be paid to the constipation which is almost always present. A course at a watering place best relieves all the symptoms. As a rule the bitter are better than the saline laxatives. Among them the physician may select the aromatic tincture of rhubarb, ʒ i. ter die; the

compound pill of rhubarb, one or two after each meal; a pill of podophyllin, gr. $\frac{1}{4}$–$\frac{1}{2}$ at bedtime; a pill of aloes, belladonna, and strychnia; or the compound licorice powder, one or two teaspoonfuls once or twice a day. Sedatives and hypnotics, bromides, chloral, etc., do more harm than good, but acids, especially hydrochloric acid gtt. xx. well diluted ter die; tonics, tinctura nucis vomicæ gtt. xx.; or strychnine nitrate gr. $\frac{1}{40}$–$\frac{1}{20}$ ter die, brace the stomach and the nervous system. Alcohol is bad as a rule. It disturbs digestion. In the subsequent reaction it leads to melancholy. The management of hypochondriasis is a matter of tact, of *savoir-faire*, of knowledge of the race and of the individual man.

NEURASTHENIA.

Neurasthenia (*νεῦρον*, nerve, *ἀσθένεια*, weakness) is an exhaustion of the nerve centres, especially observed among individuals who have inherited weakness from some weak, perhaps remote, ancestor, or whose lives of continuous occupation, strain, and competition leave no time for rest. Neurasthenia is a disease of the railroad, telegraph, and telephone life of our modern civilization. The condition is aggravated by the use of remedies to stimulate strength and enforce sleep—alcohol and morphia—and by sexual abuse and excess. Forms are distinguished as cerebral, spinal, and universal (Beard), and in these distinctions the transition lines between this affection and hysteria, hypochondriasis, and melancholia cannot always be strictly drawn. Spinal neurasthenia is very apt to include organic disease of the spinal cord, myelitis, tabes, or other scleroses.

Symptoms.—Neurasthenia expresses itself especially in *early fatigue, lack of concentration, loss of originality, incapacity of effort, headache, pain in the back of the neck, irritability of disposition, more or less constant anxiety and apprehension.* Favorite expressions of fear are agoraphobia, fear in open places; claustrophobia, fear in closed places; monophobia, fear of being alone; anthropophobia, fear of human beings; siderophobia, fear of lightning; mysophobia, fear of dirt; pantophobia, fear of everything. These conditions may be the expression of other diseases or of mere nervousness, and may be entirely absent in cases of pure neurasthenia. Most cases show *disturbances of digestion*, with dyspepsia and vertigo, sometimes with gastralgia. *Insomnia* is a prominent symptom. The patient tosses about in bed sleepless for hours, and awakens in the morning unrefreshed. Finally he forces sleep with hypnotics and thus further undermines the nerve centres. Various paræsthesiæ, hyperæsthesiæ, and hyperalgesiæ occur in the course of these cases. Localized sensations in the spinal column constitute the obstinate symptom known as *spinal irrita-*

tion. The heart's action is disturbed in various ways. *Palpitation* is common, with *arhythmia* and precordial anxiety. Onanism and impotence occur as both cause and effect in cases of neurasthenia. Sensations of coldness, numbness, formication, flushing of the face or pallor, cyanosis, tachycardia, sweatings, spermatorrhœa, vary the scene in the symptomatology of neurasthenia.

Prophylaxis is the adoption of the rule laid down by the great philosopher Kant: Eight hours work, eight hours recreation, eight hours sleep. Unfortunately modern civilization does not accept these rules, and "success" in life can rarely be reached in this way.

Treatment is *rest;* all other remedies are secondary and subordinate. The difficulty is to secure rest. Idleness, stagnation, is not always rest. In stagnation set in at once the intensely active processes of decomposition. In certain cases isolation is a necessity. Travelling is always a diversion. A sea voyage, with its inanities, secures at least absolute rest. The moving panorama observed from the window of a railroad car furnishes diversion as well as rest. A stay of a few weeks at a watering place, with its change of scene and association, may secure the desired effect. Hydrotherapy, in the form of frequent warm baths with gentle friction, is often of value. General electrization according to the method of Beard, the negative pole at the feet and the positive stroked over the body with the roller, refreshes, strengthens, and tranquillizes in the course of time. Drugs are to be avoided as much as possible, yet occasional doses of sulphonal, paraldehyde, or even of chloral may be required. Food should be administered regularly, and remedies—hydrochloric acid, nux vomica, orexin—may be given to secure its digestion.

Babes, of Bucharest, injected nerve substance itself subcutaneously, fifteen to seventy-five grains per day in bouillon, into several patients affected with neurasthenia, with satisfactory results. Similar experiments have also been made with epilepsy and tabes. The operation must be done with every precaution of antisepsis. The good results, like those obtained after the injection of the juice of the testicle of young dogs, are chiefly, if not wholly, due to suggestion, a remedy of more value in nervous diseases than in any other affection.

CHOREA.

Chorea (*χορεία*, dance), St. Vitus' dance, is a neurosis of childhood, characterized by more or less continuous spasmodic movements, with inco-ordination; aggravated by voluntary motion, arrested only in profound sleep; associated usually with some, if only slight, impairment of the mind and more or less paresis.

The disease exists in two *forms*, chorea major and minor, and

prevailed as an epidemic, as chorea major—the "dancing mania"—in the middle ages. Chorea major, from which the disease is named, is a subvariety of hysteria, and, with other forms of that disease, is rapidly spread by imitation. The victims of this affection were supposed to be cured at the chapel dedicated to St. Vitus, hence St. Vitus' disease. Chorea minor, the true chorea, Sydenham's chorea, here described, though it rests upon no discoverable constant lesion, stands in no direct relation with hysteria.

Etiology.—Chorea is three times as frequent in girls as in boys. Nearly half the cases occur between the ages of ten and fifteen, four-fifths between five and fifteen years. The disease grows more rare with advancing age, and cases which occur in extreme age are usually symptoms of some definite disease of the brain. Pregnancy sometimes causes chorea, which distinguishes itself from that of other cause by its liability to recurrence with subsequent pregnancies. It is most frequent during the first pregnancy, and almost never occurs for the first time after the age of twenty-five years. It may show itself at any time in pregnancy, but is most frequent in the third month. Recurrent attacks in subsequent pregnancies occur at any time.

Chorea is sometimes precipitated or caused by fright, in which case it supervenes rapidly—as a rule in less than a week. Cases of long interval have a different origin. The relation to rheumatism is more distinct, as fully one-fourth of all cases occur in the course of, or subsequent to, rheumatism. In a majority of these cases the chorea is evidently due to heart disease of rheumatic origin, and the sequence runs : acute rheumatism, valvular disease of the heart, chorea. In this connection the chorea may depend upon organic lesion of the brain—*e.g.*, emboli in the capillaries of the brain, a condition which has actually been demonstrated in certain cases. The actual existence of valvular disease does not necessarily imply this condition, as the chorea may be, and is in the vast majority of cases, due to the same cause which produced the rheumatism and heart disease. In other words, chorea is probably the *expression of an infection*, of defective innervation due to the action of a toxine. The more or less definite duration of the disease, and the exemption secured by single attack, speak in favor of this view. The preference of youth, and the occurrence during pregnancy, which often liberates toxines, are additional points in support of the infection theory. The fact, however, that chorea supervenes in consequence of mental emotions or impressions, especially fright, imitation, after trauma, proves that not all cases have this origin. Various organic diseases of the brain (tumors, degenerative lesions left by apoplexy, epilepsy, etc.) may be followed by chorea. These

cases of traumatic post-apoplectic or post-epileptic attacks constitute the cases of so-called *symptomatic chorea.*

Chorea is, therefore, no single process; it may be a pure neurosis, it may be symptomatic, or it may be an infection. The pure chorea of childhood, whether or not it occurs in the course of rheumatism, is probably, in the vast majority of cases, due to the same infection.

The disease may or may not have a *morbid anatomy.* Even the cases dependent upon organic diseases show no constant lesion. The conditions actually discovered are the expressions of defective nutrition, as badly nourished arteries, dilated vessels, exudations in lymph spaces, along with degenerative lesions. Many cases show no lesion whatever.

Symptoms.—The disease usually develops insidiously. There is noticed at first some *disturbance in the disposition:* the child becomes melancholy, irritable, or morose; it loses the capacity of mental effort, and is often punished at school for *lack of attention, stupidity, or forgetfulness.* It soon becomes *restless;* it cannot sit still, loses appetite, becomes constipated, and finds it difficult to fall asleep. The inco-ordinate movement of muscle is usually first shown in the face as a *quick grimace, a sudden twitching* of the mouth or wink of the eye. The voluntary movements show soon a certain awkwardness: water is spilled from a glass in the act of drinking, or food from the spoon or fork in the act of eating; the arm is suddenly jerked at the side, sometimes with some contortion of the body, to give the appearance of sulkiness. Soon *the movements become more continuous and more universal;* the leg jerks as well as the arm, the face twitches more or less continuously, and the whole body moves irregularly. This condition, which shows itself at rest, is very much *intensified by voluntary motion,* or is especially marked as the child becomes conscious of observation. The disease continues to spread over the body, until finally all the voluntary muscles are involved, including the tongue, larynx, and diaphragm. Except in the worse cases, *the involuntary muscles are unaffected.* There is no difficulty in swallowing. The bowels and bladder are perfectly normal. The muscles first affected are usually worse affected. The disease always shows its main expression in the face, and, inasmuch as it is associated with some mental impairment, it shows a peculiar physiognomy. At perfect rest the expression is listless, sullen, and dull, but the rapid play of individual muscles distorts the expression in every way. The face has the appearance of a mask, whose monotony is played upon by electric shocks, and changed from melancholy to mockery, from surprise to a sardonic grin. The voice, too, is broken, and changes in its tones in the same sentence. In bad cases the patient is *unable to*

walk, being tripped by his own legs. In extreme cases he may find no rest in a chair, or even in bed, out of which he may be convulsively thrown. In all cases the disease is more marked on one side, usually the left. Where the predominance is extreme the case is known as hemichorea.

Electric irritability is unaffected or but slightly increased. *The disease is unattended with pains or paræsthesiæ;* the sensitive nerves are unaffected, or, if affected at all, are somewhat hyperæsthetic; the reflexes are normal. Notwithstanding the incessant working of the muscles, there is *no feeling of fatigue.* Choreic patients are, however, never so strong as in health. The appetite may remain good, the bowels regular. Nutrition suffers at first from loss of sleep; later there is pallor from anæmia, which may lead to marasmus. The pupils are usually slightly dilated. The *mental faculties* in mild cases are somewhat *dulled;* in marked cases the dulness may increase to actual dementia, with involuntary discharges from mental apathy. In nervous women, in connection with puberty or pregnancy, the nervous affection may take the form of *excitement* with delusions or mania. This so-called maniacal chorea gives place in the course of a few weeks to dulness and listlessness.

Course and Complications.—The disease lasts for weeks, on an average from six to twelve weeks. It may terminate in three weeks or continue for six to twelve months. Usually in these protracted cases there are remissions of longer or shorter duration. Relapse and recurrence are frequent. A second attack occurs in one-third of cases. Instances are recorded of nine separate attacks. The occurrence of fever belongs to complications, especially to rheumatism or endocarditis. The pulse is usually frequent, and is often irregular in correspondence with the action of the heart, auscultation of which may disclose a systolic murmur at the base or actual valvular lesion. Embolus, hemiplegia, or softening of the brain may occur in consequence of the lesion of the valves. Ulcerative endocarditis in connection with chorea is almost unknown.

The *prognosis* is favorable, especially in children, but assumes some gravity with advancing age. Pregnancy aggravates the mortality, at times to twenty-five per cent. Patients usually recover absolutely; exceptional cases are followed by psychoses or paralysis.

The *diagnosis* is usually easy. The irregular, spasmodic, bizarre movements of recent and rapid onset, with the peculiar physiognomy, readily distinguish the disease.

Forms.—Chorea is sometimes closely connected with hysteria.

Hysterical chorea is often the result of imitation; the movements are more regular and rhythmic. They are also less violent than cases of true chorea.

Adult chorea occurs at any period of life, even up to advanced age, and more distinctly in connection with *heredity*. Peretti records a case where twelve descendants of a choreic woman were attacked with the disease in the second half of life. Adult or hereditary chorea is unassociated with heart disease. It is more common in men than women, and is especially distinguished by the fact that the movements are more distinctly under the control of the will.

Electrical chorea (Bergeron) is distinguished by the sudden, shock-like twitchings of muscles, like those under electricity. They are aggravated by emotion or efforts at control. Electrical chorea shows no other symptom, and these almost invariably disappear. A peculiar variety of this affection is seen in Lombardy, where it is known as Dubini's disease. The attacks leave, in the course of months, paresis and paralysis, and are sometimes attended with unilateral epileptiform convulsions. The disease is supposed to have its seat in the cerebral cortex.

Chorea major is really, as stated, a subvariety of hysteria. The movements are more co-ordinate and are much more distinctly purposive. The conscious convulsions and the exaggerated freaks of hysteria, circular movements, dancing manias, gymnastics, climbing of bedposts, etc., belong to this form of disease (see page 758).

Treatment.—The mode of life is to be regulated. The patient should be kept quiet, must be removed from school. Evidence of caprice, apparent wilfulness, or obstinacy should be allowed to pass unobserved. Peace of mind is best secured by quiet. The most valuable remedy is sleep, under which the convulsive movements cease and the nervous system rests. Sleep is best secured by warm baths at bedtime or frequently during the day. They may be repeated as often as every hour. Aggravated cases require the use of chloral, which in small doses, gr. ijss.–v.–x., with peppermint water ʒ i.–ʒ ss., usually suffices. Chloral is better than any other hypnotic, though sulphonal, trional, and paraldehyde have individual advocates. *Arsenic may be regarded as a specific in a case of pure chorea*—evidence again of the infectious origin or nature of the disease. The remedy should be given in small dose and gradually pushed to tolerance. No form is better than Fowler's solution, which may be increased from the dose of one or two to ten or fifteen drops three times a day after meals. Irritant effects, pain, diarrhœa, may be avoided by the administration at the same time of a few drops of tincture of opium. The disease is in this way usually cut short one-half or one-third its natural duration. Rheumatic complications call for the use of the salicylates. Faradization and massage assist in supporting the nutrition of the muscles. Iron, strychnia, and hypophosphites are the best general tonics in the way of drugs. Food

and fresh air are absolute essentials throughout the whole course of the disease.

PARALYSIS AGITANS.

Paralysis agitans; shaking palsy.—A peculiar paresis, attended by tremors of individual members or of the whole body, which tremors may be suppressed for a time by act of the will, ceasing altogether or becoming feebler in sleep; normal electro-motor and reflex excitability; inclination of the body forward.

History.—Paralysis agitans was first described as a separate disease by Parkinson (1817), who distinguished it from chorea and other tremors. Parkinson's brief but graphic account excited, however, but little attention, and the character of the disease was only fully appreciated after the descriptions of Marshall Hall, Stokes, and Todd in England, Romberg in Germany, and Trousseau in France (1840–1860). Charcot (1867) separated the disease from multiple or disseminated sclerosis.

Etiology.—In comparison with other neuroses the disease is rare

FIG. 298.—Position of the hand (pill-rolling) in paralysis agitans (Charcot).

and belongs to advanced life. Males are affected more frequently than females, in the proportion of five to three. It is more common in the lower walks of life. The rôle of heredity is insignificant. It has followed in the course of acute infections, more distinctly after trauma, and more frequently after psychical distress, as after fright.

Pure paralysis agitans is no longer a neurosis. It has now a distinct *morbid anatomy.* Ketscher found abundant degenerative changes in the brain and cord in three cases, and identified them with the changes in ten cases which occur in old age. Paralysis agitans is, therefore, in reality a premature senescence.

Symptoms.—The disease develops slowly. The onset may be more rapid when the affection follows fright. The symptoms are noticed first in the *upper extremity,* more frequently in the right than in the left. The hand loses its cunning. The first loss is noticed in the finer movements, as in writing, drawing, etc. Associated with the weakness, preceding it in the majority of cases, is the

tremor. It *begins in the hand*, in the thumb and index finger, sometimes in the shoulder, and gradually extends, most frequently in the order of hemiplegia—that is, from arm to leg on the same side. In exceptional case this course may be interrupted. Thus, it is not so regular when the disease begins in the lower extremity. A common beginning is that agitation of the thumb and forefinger as if rolling a small body, a pill. In the leg the tremor is most marked in the foot. In sitting the heel may beat a tattoo upon the floor. Though the muscles of the back may be affected, the muscles of the abdomen escape. *The head is not affected*, though it may be indirectly agitated by movements of the trunk. The face is very rarely involved. The tremor is distinguished from that of other or allied affections by its *persistence during rest.* The motion is continu-

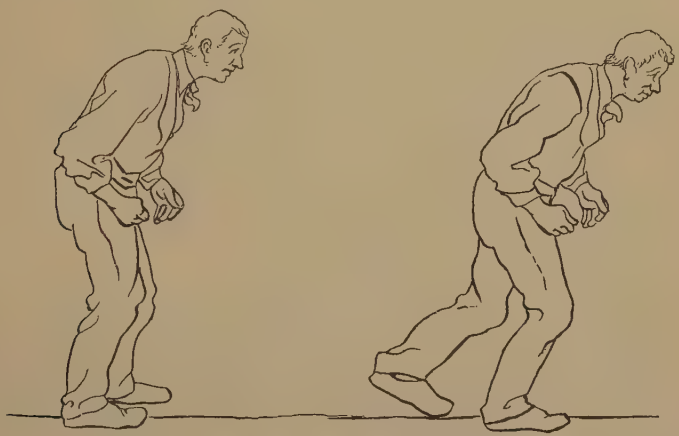


Fig. 299.—Attitude and gait in paralysis agitans (Dana).

ous; the hands move upon the knees. *It is arrested for a time by volitional effort*, but renews itself and attends its continuance. Efforts to control it, at first successful, intensify it later. It is first recognized in the *handwriting.* The letters are distinct, but the lines are zigzag. Fine variations may be recognized by the lens. Stiffness sets in later to limit movements of various members. So the head may be fixed upon the breast, the arms flexed, the fingers deformed as in arthritis deformans, the feet brought to the condition of varo-equinus. *The whole body is bent forward* as in running. *The step is short, quick, and tumbling.* The expression is impassive. Extreme cases may be reduced to forced movements forward or backward. Sleep stops the tremors at first. Electric reaction is normal. The reflexes are undisturbed. There is usually more or less emotional disturbance, *melancholy*, from loss of power. Tactile

sensation remains unaffected, that of temperature is disturbed, in three-fourths of the cases. Victims of shaking palsy *suffer with heat.* They cannot bear cover even in cold weather. Aside from the melancholy mentioned, the intellect is undisturbed. Exceptional cases show mental failures, convulsions, cramps in the legs, etc.—symptoms probably due to organic complication.

The disease is as slow in progress as in onset. It may last for decades, but usually cuts life short through its remoter effects, as want of exercise, bed sores, with sepsis, gradual marasmus, etc.

The *diagnosis* is established by the age of the patient, by the peculiar habitus, continual rhythmical movements arrested only in sleep, with the persistence of the reflexes and electric reactions. Paralysis agitans is differentiated from multiple sclerosis by the facts that (1) sclerosis occurs before forty; (2) the movements, in paralysis agitans arrested or reduced, are in sclerosis intensified by volitional efforts; (3) paralysis precedes the tremor in sclerosis, and, as a rule, follows it in paralysis agitans; (4) sclerosis affects the head and shows nystagmus, conditions which do not occur in paralysis agitans; (5) the words are disarticulated in sclerosis, and are rather run together in paralysis agitans, which shows also the *piping voice* (Shakspere's childish treble) commonly, but very erroneously, ascribed to age; (6) paralysis agitans usually shows itself first in the upper, sclerosis in the lower, extremity.

The *tremor of age* is distinguished by its more universal dissemination and early implication of the face. *Toxic tremor*, as after mercury, lead, etc., is distinguished by the presence of toxic signs.

Prognosis.—Paralysis agitans is incurable. It may be relieved or temporarily retarded. It is unattended with immediate danger to life.

The *treatment* calls for rest, relief of anxiety and fatigue. Electricity is of little or no value. Nerve stretching is dangerous. The only remedy which merits the name is arsenic, which produces its best effect when used subcutaneously. The liquor potassæ arsenitis is diluted with twice as much water and injected under the skin of the back. The dose, small at first, should be gradually increased to tolerance. Anodynes, which may be demanded in extreme cases, should be used with caution and selected with care. Indian hemp more especially hyoscyamine gr. $\frac{1}{120}$–$\frac{1}{100}$, is to be preferred to opium.

MULTIPLE SCLEROSIS.

A disease caused by the development of scleroses throughout the brain and cord, characterized by tremor, evoked or exaggerated by effort, scanning speech, nystagmus, pareses in various muscles;

often with contractures, increased reflexes, preservation of sensation; occasionally by amaurosis, apoplectiform attacks, and delirium.

History.—The disease is of modern recognition, and, though observed by Carswell and Cruveilhier and described by Frerichs, was especially set apart and distinguished by Vulpian and Charcot, who isolated cerebral, spinal, and cerebro-spinal cases according to the seat of the disease. In most cases the process is disseminated, and consists of islets of sclerotic tissue scattered through the substance of the brain and cord.

Etiology.—Heredity is insignificant; sexes show no difference; age is of most moment. The majority of cases occur between twenty and thirty-five; exceptional cases have been recorded as early as seven and as late as sixty years. The disease has followed apparently in consequence of trauma, the infections—typhoid fever, small-pox, diphtheria, and erysipelas—and in the course of pregnancy after exposure to cold, after severe mental and bodily strains, etc. It has developed in the course of a year after recovery from myelitis or other acute affection. In a case under observation of the author at the time of this writing, the sequence ran: hæmorrhage in the cord after violent effort; myelitis with paralysis of the bladder and bowels; at the end of a year volitional tremor, scanning speech, nystagmus, and spastic contraction of the lower extremities.

Morbid Anatomy.—The disease consists, in essence, of depots of condensed tissue, varying in size from the barely visible to masses of the diameter of ten centimetres or more. These masses are indurated, sometimes elevated, sometimes sunken, gray or white, smooth or lustrous. They are seen to consist, under the microscope, of hyperplastic connective tissue. The nerve tissue proper is shrunken and wasted. The vessel walls show hyaline degeneration with varicosities. The white substance is shrunken to a narrow ring about the axis cylinder, which persists for a time and finally disappears.

Symptoms.—The symptoms of multiple sclerosis are said to be kaleidoscopic; they vary according to the seat of the disease. The *onset is insidious*, seldom sudden, and is distinguished, when it begins in the brain, by *headache, vertigo, and psychical distress.* Cases of more sudden onset simulate attacks of apoplexy. Beginning in the cord, the disease shows itself first in *lack of co-ordination, early fatigue, tremor.* The tremor is *first noticed in the arms;* it extends to involve the lower extremities, and in the progress of the disease does not spare the face. The tremor is peculiar and characteristic. It is at first absent at rest, and *shows itself only on movement.* Later it is more continuous, but is always more intense in efforts of the will, or under observation or emotional disturbance. The more the patient tries to control the movements the

more uncontrollable they become. The movements become wild and irregular; the patient spills water in an attempt to take a drink. The disease is hereby distinguished from paralysis agitans, in which tremor or movement is arrested or inhibited by efforts of the will. As a modification of this tremor is the *alteration of speech*, which consists in the disarticulation of words in syllables expressed in monotones. The effect is that of *scanning*. Speech is often interrupted also by sudden inspiration, hiccough, etc.

Spastic contractions are more frequent in the lower extremities. Patients sometimes present the appearance of cases of lateral sclerosis. The reflexes remain unaffected or are later intensified. Various paræsthesiæ occur in individual cases. *Nystagmus* is often associated with impairment of vision, as the tremor of the whole body is later followed by paresis. The disease is slow in its progress, and is more or less progressive, with periods of apparent arrest or sudden aggravation. Attacks of *vertigo* are frequent in all stages of the disease. Attacks of *apoplexy* occur in about twenty per cent of cases. A *sudden coma*, with elevation of temperature, is followed by hemiplegia or by intensification of all the symptoms.

The *diagnosis* rests upon the tripod formed by the prominent symptoms—volitional tremor, scanning speech, and nystagmus. These symptoms, in association with the preservation of sensation and escape of the bladder and bowels, distinguish the disease in most cases. It must be remembered, as stated, that the picture varies with the site of the lesion. The disease lasts two to twenty years, on the average five to ten years. Death results from apoplexy, cystitis, decubitus, marasmus.

Treatment is of little value. Warm baths are beneficial in staying the progress of the disease. Cold of all kinds is injurious. Regarding exercise, it is difficult to draw the lines to avoid the Scylla of fatigue and the Charybdis of degeneration from disuse. Electricity in all forms seems to be useless. Arsenic has recommendations. It is customary to prescribe arsenic in doses of three to five drops three times a day.

DEMENTIA PARALYTICA.

Dementia (*de*, privative, *mens*, mind) paralytica (a much finer designation than its synonyms, progressive paralysis of the insane or general sclerosis) is a wasting disease of the brain, usually of insidious onset and slow course, marked by alteration of the disposition, signs of insanity, delirium of grandeur, affection of speech, tremor of the lip and tongue, loss of light reflex in the iris with other signs of tabes dorsalis, intercurrent apoplectic and epileptiform attacks, irregular—*i.e.*, fitful—but progressive degradation, and death.

Dementia paralytica is a frequent disease, but is often overlooked for months or years, or diagnosticated under some of its advanced or grosser signs as "paralysis," "insanity," or "softening of the brain." The credit of the separation of the disease as a definite malady is due to the distinguished alienists of the old French school, especially to Calmeil and Esquirol.

Etiology.—The most common cause of dementia is syphilis, but the disease occurs, not as an immediate complication, but as a remote sequel of syphilis. With tabes dorsalis, many of whose symptoms it shows, dementia paralytica is not a para- but a meta-syphilitic phenomenon. The relation of alcoholism is neither so strictly defined nor so generally accepted. Brain worry, especially from failure in life, is often assigned as a cause, without other reason than sequence. Real brain work—*i.e.*, intellectual work—produces no dementia. On the contrary, brain work protects the brain from waste. Heredity plays the same rôle as in most nervous diseases—that is, epilepsy, hysteria, insanity, etc., in the ancestry predispose to dementia in posterity. Dementia is a disease chiefly of the male sex, of maturity, about forty, and age.

Symptoms.—The mental faculties suffer first, as a rule, and the disturbance begins in the sphere of the *emotions.* The patient becomes irritable, more especially sensitive. He is easily excited, angered, or hurt. He flies into a passion or weeps without apparent cause or from some imaginary cause. He may, exceptionally, observe the change himself; as a rule the friends notice it first. What pain is endured by silent sufferers (relatives and friends) for months or years is only learned as the cause is understood with the lapse of time.

Most patients enjoy good health at the start and often far into the course of the disease. Sometimes, with the appetite of a glutton and the indolence of ease, there is unusual euphoria.

Most patients are optimistic, or are for a time serenely, even inordinately, happy. They soon begin to entertain *ideas of grandeur.* They imagine themselves endowed with genius, wealth, power. One patient, treated by the author, owned all the land in the State of Ohio and had gigantic schemes for the disposition of it. Another had invented a machine of "oiled walnut and steel wheels"—this was all he knew of the construction of it—which he intended to fix on top of the Mechanics' Institute, whence he would regulate the movements of the planets.

In and bordering on this state of mind men have disposed of their possessions, dissipated large fortunes, and contracted heavy debts.

In exceptional cases the opposite condition prevails. The patient falls into *melancholy,* sits dejected and distrustful, still and silent,

the entire day. Attacks of this kind occur also in the more common states of expansive delirium; but they are usually transitory, lasting a day or two, or even a week or two, to be substituted by the condition more natural to the disease.

These changes are light or severe in individual cases, but are in either case appreciated by intimate associates, and soon, because permanent, come to be generally known. In other words, *the character* of the individual *is changed.*

At this time, or before the change has been noticed—for the observance of change depends also upon the observer—evidence of *paralysis* begins to appear. It shows itself first in the *face* and *tongue*, and is noticed especially or obtrusively in the speech. Articulation becomes difficult, syllables and words are dropped or confused. The change is noticed first with unusual words, and the speech is much like that of alcoholism, which indeed produces a dementia of its own in time. Thus the patient will say "incalable" for "incalculable," "artrerrilery" for "artillery," "eletrity" for "electricity," etc. The attempt to pronounce the phrase "mathematical demonstration" excites a smile of compassion, at least. A good test is such a demonstration, whereby it is seen that the patient may still perform sums in simple addition, but in multiplication he is at fault, and in division fails entirely. So much here depends, however, upon the amount and direction of previous training. At this time—as a good test of the lapse of memory—it is difficult for the patient to recall the date of his birth, something that everybody knows.

Soon—that is, sooner or later—*the lower lip trembles.* The patient looks as if about to burst into tears. In more advanced cases the lip falls away from the teeth. The *tongue is tremulous;* so much so, often, that the patient cannot protrude it, or, protruding it, cannot control it. Fibrillar twitchings and pareses affect also other muscles of the mouth and cheeks, so that food may fall from the mouth, and the patient at an early stage may have to be fed. Later there may be also difficulty with deglutition, so that the disease may resemble or be associated with bulbar palsy. These bad signs may, however, all disappear again, and the patient survive a year, as in the case of a colleague of the author, or longer, as in recorded cases.

Many of the symptoms of tabes are now wont to appear. Thus there is, or may be, paresis or paralysis of the bladder (a very ugly complication, necessitating great care with the catheter), absence of knee jerk, loss of reflex in the pupils, impotence, ataxia, paræsthesia, or pains, though the pains are never as severe as in tabes. Migraine, supra-orbital neuralgia, scotoma, monoplegia of short duration, may vary the scene. Charcot says certain patients present

themselves to the physician with sensations of distress in the tongue, "apprehensive of cancer of the tongue," and will not be assured to the contrary, as prodromata of paralytic dementia. If these or similar sensations, more especially formication and numbness of the limbs, are felt in association with disturbance of speech and alteration of disposition in a middle-aged man in previous health, the disease is probably dementia.

It must be remembered, however, that no one of these symptoms is essential to a diagnosis. The knee jerk may persist in some cases; it may be increased and associated with spastic contractions.

More characteristic events are the *apoplectiform*, more strictly *epileptiform*, attacks which set in later in the course of the disease, sometimes to cut it short fatally; oftener to be recovered from rapidly, but with life on a much lower plane.

The patient may now find it difficult to express himself in any direction. He stops in the middle of a sentence, loses the word, loses the thought, is vacant, as if a veil had fallen between.

Morbid Anatomy.—The whole brain is atrophied. The pia is thickened, opaque, and adherent. The vessels show signs of atheromatous change. The hyperplasia of the connective tissue is so great as to have led to the view that the process was essentially an interstitial encephalitis. In bad cases the surface of section, with its indurations and vacuoles, looks like the surface of a piece of Swiss cheese. The disease begins, however, always in the nerve elements themselves. The convolutions are small. The ganglion cells are degenerated. Prolongations, poles, are lost. Nerve fibres are shrivelled. The same degenerative, indurative changes are found in the cord with the evidence of more or less extensive tabes dorsalis. The whole process impresses the observer as the destruction and wreck of a general diffuse sclerosis, which, in fact, the disease is declared to be.

The *diagnosis* is easy in a case with all the symptoms set in course. It rests chiefly upon the change of disposition, affection of speech, fibrillar tremor, especially of the tongue, the delirium of grandeur, or, exceptionally, the melancholia, the epileptiform attacks, etc.

But the diagnosis may be difficult or impossible at the start. Here must be taken into account the finer changes of disposition or temperament, attacks of migraine, double vision, the altered handwriting, in association with one or more of the more distinctive signs.

Dementia paralytica must be differentiated from the dementia which may follow or occur in the course of epilepsy and alcoholism, as well as from the dementias secondary to mania, melancholia, paranoia, or other pure psychoses. The preceding history helps to make this diagnosis. Senile dementia is the imbecility of old age.

Prognosis and Course.—The disease is chronic, and, though subject to remissions and periods of quiescence of weeks', months', even years' duration, it is, as the name implies, progressive. Thus dementia may last for years with exacerbations or with such apparent improvements as to make an absolute statement of the probable duration of life impossible. Galloping cases may take life in a month. Protracted cases last ten years. Average cases extend from one to three years. Death is by an apoplectic attack, by cystitis, decubitus, intercurrent pneumonia, marasmus.

Treatment.—As in the case of its allies and congeners, the other scleroses, the treatment is wholly symptomatic. States of irritation are subdued by the bromides, gr. xxx.–xl. largely diluted ; sleeplessness is allayed by trional, gr. xv. in a cup of hot tea at bedtime. All forms of alcohol are to be avoided.

The judicious use of morphia in small daily dosage, by stimulating brain cells not yet attacked or entirely destroyed, will postpone the wreck which is in all cases inevitable at last. Close attention must be paid to the bladder and bowels.

Life is best prolonged by peaceful surroundings. When the patient is gentle or childish he may be kept at home ; where violent he should be sent to an asylum.

AVOCATION NEUROSES.

Avocation neurosis, the most common example of which is writer's cramp, is an expression of exhaustion of the nerve centres. It is the result of the excessive use of the same muscles in the same way. The neurosis may show itself in other forms of nerve exhaustion than cramp. The act of writing, including typewriting, furnishes the largest contingent of cases ; but as other avocations may produce the same result, the diseased state is better known as an avocation neurosis. Thus typical cases are encountered among piano players. Reuter recorded the case of a celebrated composer in whom the right middle finger had refused service for ten years on account of spasmodic extension whenever he sat down to play. Violinists are not exempt. Berger mentions the case of a hypochondriac violinist who was seized with pain in the left shoulder and spasmodic cramp of the left hand, which he could prevent only by holding the instrument in an unusual way. Tailors and fine-sewing women are sometimes attacked with a "stitch cramp." Duchenne described a case attended with a spasmodic rotation of the arm inward. Onimus reported cases among telegraphers, and Hamilton mentions the letters most difficult of record in these cases. Cigarmakers, cow milkers, watchmakers, shoemakers, smiths, even pugilists, have all been unfitted for their avocations by like conditions.

The disease does not confine itself to the upper extremities and trunk. Men who have had to tread mills have been seized in the sole of the foot. Scissors grinders, treadle operators, and sewing-machine workers may be affected in the legs. The danseuse on the tiptoe is not infrequently affected in the muscles supplied by the tibial nerve.

Etiology.—Aside from the avocation, the disease belongs to the neuropathic temperament. Individuals of irritable, sensitive nervous systems, with multiform hypochondriac or other functional neurosis, are most frequently affected. Thus the avocation neurosis occurs most frequently in people affected with neuralgia, headache, facial spasm, strabismus, stuttering, etc. It has been noticed in connection with chorea, epilepsy, paralysis agitans, and psychoses. Alcoholism, onanism, sexual excesses, precipitate attacks. Patients themselves often show other nervous disturbances, as irritability, sensations of pressure about the head, vertigo, palpitation, nervous dyspepsia, etc. The condition is most apt to occur with the mechanical writers, especially with those who take pains to write well and attend more to the form than to the meaning of words. Authors seldom suffer. Clerks, secretaries, amanuenses, bookkeepers, are the victims of this disease. Cramped surroundings, bad postures, wrong methods of writing and holding the pen, hard pens, are predisposing factors.

Symptoms.—The disease begins with a sense of *weakness* and weariness ; the hand and arm suffer early fatigue. The sensations disappear with cessation of writing, but with its resumption *cramp* soon supervenes, the fingers close about the palm with the peculiar pain characteristic of cramp. Effort of the will, instead of subduing, aggravates the condition. Rest restores tone to the overworked muscles, and the cramp ceases. But work after too short an interval is followed sooner and sooner by cramp more and more profound, until finally the spasm may extend up the arm to the forearm, neck, and even the face. The author had a case in which the spasm of the arm, neck, and face became epileptiform. The individual, a clerk in the auditor's office, had his head drawn down on his shoulder and his hand twisted backward during the cramp. The pain he would experience at this time would cause him to cry out. Thus enforced work extends the disease to induce finally organic lesion in the cord. *Palpitation of the heart, precordial anxiety,* conditions bordering on epilepsy, develop in the history of the unfortunate individuals who must continue to work.

But cramp does not constitute the sole or even a necessary factor in the symptomatology of the disease. Many cases show no cramp at all, and the disease expresses itself in other forms of muscular

exhaustion—to wit, *tremor and paralysis*. But cramp is the most frequent symptom. Thus in the sixty-four cases recorded by Berger twenty-four were purely spastic, ten purely paralytic, and eight purely tremulous. The remaining twenty-two cases were mixed; cramp was present in all in thirty-four cases. The kind or form of neurosis with which the patient is afflicted is easily discovered. In the use of the pen the spastic variety makes zigzag lines, after the manner of a man writing in a wagon jolting over a rough road; the tremulous is the chirography of extreme age, the letters are small and wavy; the paralytic variety soon stops—it may form but a letter or two.

The *prognosis* is bad. A few cases recover entirely. Individuals unable to rest the hand or change the avocation seldom recover entirely.

The *treatment* is *rest*. The substitution of other fingers or of

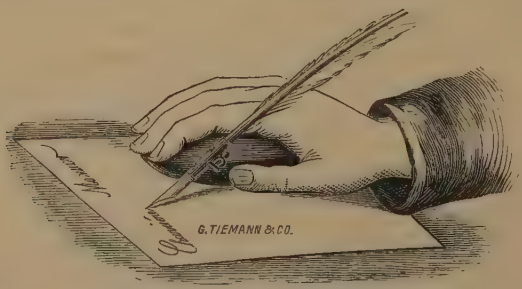


Fig. 300.—Duchenne's apparatus for relief of writer's cramp.

the left hand in writing changes the disease ultimately to them or to that side. The various mechanical devices of support may relieve at first, but they all prove futile at last; tenotomy and nerve stretching produce no permanent results. The tone may be sustained for a time by strychnia in gradually increasing doses, but without rest there is no real relief. Aside from rest, galvanization is the true treatment of writer's cramp. Duchenne was forced to admit that faradization was of avail only in the paralytic and anæsthetic forms of the disease. The negative pole should be placed at the nape of the neck, the positive stroked over the affected muscles of the forearm. Galvanization should be gentle and the sessions brief. Hydrotherapy, manual gymnastics, massage, may assist treatment.

INSOLATION—SUNSTROKE.

Sunstroke, heatstroke, occurs most frequently in hot lands in summer, but may be observed also at other times and places under like condition, as among firemen in the holds of ships, children in

overheated apartments. Heatstroke has assumed epidemic proportions in army life. In the passage of the Mincio 2,000 of the 12,000 soldiers at Antemarres were attacked with heatstroke, and 26 died. Maclean relates that at the attack on Chiang-Kiang-Foo, in the first Chinese war, the men, still enveloped in rigid stocks, heavy clothing, and impedimenta, were charging up a steep hill. A great many were stricken down; fifteen died almost instantly after a few convulsive gasps. In army life the condition is confined to the foot soldiers; the cavalry escapes. Heatstroke occurs especially among the working classes. Most cases occur in hot, humid weather without wind or breeze. In dry weather the evaporation of sweat reduces the temperature. At an artificial temperature of 130° to 140° F. even the most profuse secretion of sweat will not suffice to protect the body from overheating. When the clothes become saturated with sweat, exhalations of the body are prevented, evaporation almost ceases at the surface, the temperature continues to increase, carbonic acid accumulates, and stupor, coma, and convulsions supervene. These conditions are precipitated all the more rapidly if the individual at the same time suffers thirst and the quantity of water in the blood is reduced.

Morbid Anatomy.—Autopsy reveals early rigidity with dryness of the muscles. The blood is thin and dry, the brain and lungs hyperæmic; the left ventricle is empty, the right ventricle is full. Köster found hæmorrhages in various parts of the sympathetic.

Etiology.—Antonini regarded sunstroke as an acute neurosis of the vaso-motor system. Senfleben, as the result of his observations on lower animals enclosed in hot boxes, ascribed the results to disorganization of the blood, disintegration of red blood corpuscles, accumulation of urea. The temperature of a rabbit put into a hot box at 96° F. increases to 106° F. The pulse and respiration increase rapidly; the surface vessels are dilated. At 104° F. the body heat rises to 112° F., and the increase in respiration and pulsation is enormous. The pupils are dilated, the muscles relaxed, and death soon occurs from paralysis of the heart. The protoplasm of the muscle of mammals coagulates at 112° F., a fact alone sufficient to explain the cause of death. Animals perish under a continuous stay in a hot box, though the body heat may not rise above 108°. Under such conditions fatty degeneration occurs in many tissues. Wood showed that heating the brain of a mammal produces sudden insensibility, with or without convulsions, at a temperature of 108° F., and death at a temperature of 113° F., and that the life of the blood, as evidenced by the amœboid movements of the white blood cells and the absorptive power of the red blood cells, is not destroyed by any temperature reached in sunstroke; moreover, that if heat be withdrawn before

it has produced permanent injury, the convulsions and unconsciousness are immediately relieved and the animal recovers. The damage is not dependent, therefore, upon blood poisoning, but upon the heat itself, and is due probably to direct effects upon heat-regulating centres in the pons and medulla.

Diagnosis.—Heatstroke is differentiated from apoplexy by the fact that the fever precedes the stroke of heat and follows the stroke of apoplexy. The rapid pulse and respiration of heatstroke are also points of distinction.

Prophylaxis.—Heatstroke is prevented by avoidance of the heat of the day, as in hot countries by a siesta at this time; by temperate habits, moderation of work or marching, regulation of clothing, abundance of drinking-water, which should be taken frequently rather than in large quantities.

The *treatment* is the application of cold, best in the bath, at first at a temperature of 80°–85°, and then rapidly reduced with ice. The patient, on withdrawal from the bath, should be quickly dried and covered. The bath may be preceded with advantage by a moderate dose of whiskey with gtt. xx.–xxx. tincture of digitalis (Guiteras). Where this treatment is not practicable the patient should be douched at once from the nearest water supply, and masses of ice may be rubbed over the head and body. Patients once affected with heatstroke suffer for a long time, sometimes for life, under subsequent exposure to heat. Attacks of epilepsy may ensue upon each occasion. Strychnia gr. $\frac{1}{40}$–$\frac{1}{20}$ best obviates the cardiac and cerebral depression following sunstroke.

CONGELATION—FREEZING.

The human body can endure wide ranges of temperature. If the air be dry, life is possible at a temperature of 212° F., and at the lowest grades, even below −50° F., or any temperature encountered anywhere on the surface of the earth. Consequently death by freezing is not common. The various expeditions made to the North Pole record no death by freezing. When it occurs, it is met with, of course, most frequently in the colder climates, Russia, Siberia, etc., and in the country rather than the city, as in long night rides or when travellers are lost in the snow. But statistics differ. Samson-Himmelstern, St. Petersburg, found death by freezing 16 times in 220 autopsies in seven years. Dieberg puts the proportion at ten per cent, while Caspar-Liman, Prussia, in 100 cases met with but 2 which were said to be deaths by freezing. Here, with us, death by freezing occurs but once in three or four years, and then usually in the case of a street-car driver, who is sometimes found frozen at his post.

But while death from freezing is uncommon, local congelations

are very frequent. In St. Petersburg, 1870, there were but 3 deaths from freezing, but 700 cases required treatment. In a single hospital there occurred in a decade 494 cases (456 males) with 42 deaths, all from complications which occurred as sequelæ—thus, 18 from pyæmia and septicæmia.

There is no thermal or athermal death point. Reincke once found, in the case of a drunken laborer frozen on the street, a temperature of 75° F. in the rectum. The patient nevertheless recovered. An animal (rabbit) cooled down to 66° F. cannot recover of itself, but it may recover under heat and artificial respiration, even after apparent death for forty minutes. Walther was able to recover animals from a body temperature as low as 48° F., and Horwath young animals from a temperature as low as 40° F.

The temperature at which a man will freeze depends upon various circumstances, as age: the old and the very young quickly succumb; the aged lose heat quickly on account of feeble circulation; the new-born part with it readily, notwithstanding the active heart, on account of the slight mass of the body. Clothing, shelter, motion, wind, dryness and moisture of the atmosphere, make a difference. Hunger makes ready victims. Wounds, especially those attended with loss of blood, greatly reduce resistance. A powerful influence is exerted by depressing mental emotions. In the retreat from Moscow the French suffered appalling mortality. Larrey relates that on January 2d, 1845, in the retreat toward Sétif, though the temperature was only 35° F., 208 of 2,800 soldiers perished from cold; and of the remainder, 525 had to be taken to the hospital, where 21 subsequently died. These men were hungry, wet, and cold. Under such conditions men have died from freezing at temperatures where other men were enjoying themselves skating upon ice.

Alcoholism is the most frequent of all the conjoined influences. Two-thirds of all the cases of freezing in St. Petersburg occur among drunkards. Liman declares that he never saw an unmixed case of freezing. Death results from the combined effect of hunger, sickness, alcohol, and cold.

There is no duration of exposure to cold which is necessarily fatal. Remarkable experiences are related by the monks in the Swiss mountains. Krajewski[1] reports that a Russian peasant was found living under snow after twelve days' exposure. This man recovered after two months' illness.

The *symptoms* of freezing are general and local. 1. There is first a sensation of chilliness and a *feeling of intense cold*, which increases to actual suffering. Drowsiness sets in and the *tendency to sleep* becomes irresistible; the special senses are obtunded, the

[1] Schmidt's Jahrbücher, 1861, Bd. cx., p. 330.

sight is veiled, the hearing dulled, the touch blunted ; and though the patient may resist sleep for a time, with the knowledge that to yield to it is fatal, he finally, if unsupported, falls senseless to the ground. Death now occurs rapidly or slowly, according to circumstances. When death is rapid it is usually preceded by *bleeding from the nose,* often by involuntary and unconscious discharges. When it is more slow the pulse is gradually reduced to 40–50, respirations to 8, per minute. It may be days before death finally occurs. When the patient recovers from a severe case he is apt to suffer violent headache or delirium ; sometimes paralysis ensues.

2. The first effect of cold is contraction of the vessels, so that the *surface* becomes *pale or white.* The vessels subsequently dilate and the *surface* is reddened or rendered *blue or livid.* These local effects are seen on the exposed extremities, the ears, the nose, fingers, and toes, where they constitute what are known as *chilblains* or frost erythemata—commonly, frost bites.

Freezing occurs in three modes of severity : 1. The vessels are simply dilated and are again restored and the parts recover their natural tone ; or the vessels remain dilated or more especially dilatable, so that surfaces once frozen show hyperæmia upon every new exposure to cold. Such surfaces are attended with sensations of *burning or numbness,* or, more particularly, *intolerable itching,* especially at night, which is only partially relieved by scratching or other irritation. Sometimes this susceptible condition, which represents a subparetic condition of the capillaries, remains for many years.

2. In the stage of vesiculation *blisters* are formed. Entire restitution is also possible from this stage.

3. Gangrene with *destruction of tissue.*

Winiwarter describes a peculiar thickening of the intima which occurs in arterioles subject to freezing as a cause of occlusion and gangrene. Malum perforans pedis has been observed to occur after congelation. Though the patient may recover with life, with the loss of gangrenous parts, he may subsequently succumb to sepsis, tetanus, etc.

Morbid Anatomy.—Congelation has a medico-legal aspect. It is sometimes important to know if the freezing was a homicide. The idea of suicide cannot be entertained, as the suffering is too great and the victim would necessarily seek shelter. There is no doubt that new-born babes have been killed by exposure to cold. There are, however, no signs by which the fact could be determined that a body had been frozen to death. The body is of course rigid. It is sometimes frozen through, so that the contents of the stomach are found solidified and blood is actually frozen in the heart. The natu-

ral post-mortem rigidity persists after the body has been thawed out. Sometimes extremities, fingers, toes, nose, ears, etc., have been broken off; this is a very rare occurrence and is no proof of congelation. The cranial bones have been found separated—proof, however, only of the fact that water expands and bursts the vessel that contains it, exactly as it bursts an earthen jar.

The internal organs are found, as a rule, intensely congested. This is the case also in alcoholism, the condition especially to be distinguished, but often impossible of distinction because conjoined with congelation. One thing is certain, a frozen body does not decompose, and the evidence of decomposition proves that the body was exposed after death. This point is often of value in cases of long absence, as when an individual has disappeared in the summer and the body has been found in the winter, frozen, and in a state of partial decomposition.

Rather more valuable evidence is furnished by the redness of the skin and redness of the blood; but both states are not always present in freezing, and are sometimes present in death from other causes. Redness of the skin, or red patches on the skin, are more common than redness of the blood. These conditions are due to the direct effect of cold on the hæmoglobin, and are always post-mortem phenomena.

The cause of death from freezing has been variously attributed to direct action on the corpuscles (Rollet), to influence on the nervous system (Crecchio), to congelation of the muscular tissue (Horwath), but, as Blumenstock remarks, the action is too complex to attribute it to any one cause.

The *prognosis* depends upon the grade of freezing, the strength of the individual, and various surrounding circumstances. Most patients recover from frost bites in the course of time, and recovery is always possible from septic states, and even after gangrene with sloughing, though the prognosis here is necessarily grave.

The *treatment* in local frost bites consists in the slowest possible application of heat, as by means of friction with snow and later with mild anodyne applications, as with equal parts of linseed oil and lime water (Carron oil), or diachylon ointment. The indications are to restore heat gradually and to relieve stasis. Stasis is best relieved by vertical suspension. The hands or feet are put at right angles to the body, or at least reposed upon inclined planes. All local hyperæmias disappear at once under this treatment. Chilblains are best treated by strapping with adhesive plaster. The strapping must be close and firm, and the straps should be allowed to stick or stay on for three days. If the surface is broken the salicylated plasters are the best.

Frost bites of the second grade are treated exactly as are burns, by mild emollient applications, as the Carron oil referred to. The following is a fine dressing for burns :

℞ Europhen..... 3.0
Olei oliviæ..... 7.0
Vaselini..... 60.0
Lanolini..... 30.0
M. S. Apply to the surface.

Care should be taken not to remove the cover of a blister, which is itself the best natural protective. Gangrenous processes fall in the domain of surgery.

SATURNISM—LEAD POISONING.

Saturnism, plumbism (*plumbum*, lead), occurs in two forms, acute and chronic, entirely different from each other. Acute Lead Poisoning is not common, as very large quantities of any salt of lead are necessary to produce dangerous effects. As much as a drachm of the sugar of lead is sometimes taken without evil effects. Yet cases have occurred where lead poisoning has assumed epidemic proportions. Bancks, of Stourbridge, reported such a case, where thirty pounds of acetate of lead became mixed by accident with eighty sacks of flour, and the whole mass was made by the bakers into bread, from the eating of which five hundred people were attacked with lead poisoning. Poisoning sometimes occurs from the glaze of crockery ware, solder of metallic kitchen vessels, white lead used in confectionery, red lead in the preparation of lobsters. Babies may be poisoned with the lead of rubber nipples, from painted toys, glazed cards, etc.

Acute lead poisoning runs its course with the *symptoms* of gastritis, *pain, vomiting*, and, in bad cases, *rapid collapse*. The *diagnosis* is established by the detection of lead in the vomited matters. The ammonium sulphide produces a black precipitate in acid solutions which contain less than the one-hundred-thousandth part of a lead salt.

Chronic Lead Poisoning is much more common, as any salt of lead, even the most insoluble, will produce symptoms in the course of time. The condition was known in the remotest antiquity. Avicenna described it. The first exhaustive monograph was written by Tanquerel des Planches (1830).

Chronic lead poisoning is observed most frequently in workers in lead, in painters, plumbers, glaziers, enamellers, etc. Snuff and chewing tobacco take up two and one-half to three per cent of lead from lead foil envelopes. Poisoning occasionally results from the use of water from lead pipes, though protection is here usually secured

by the fact that the pipe becomes coated with the insoluble sulphate. Very small quantities of lead suffice to produce symptoms. The house of the king of France was poisoned in the course of seven months by drinking-water which contained 0.0002 per cent. But very small quantities are ever found in the body. Thus Heubel could detect in his experiments upon dogs, after long administration of the acetate of lead, in the bones but 0.025 per cent; in the kidneys, 0.012 per cent; liver, 0.01 per cent; spinal cord, 0.006 per cent; brain, 0.004 per cent; muscles, 0.002 per cent; intestines, after separation of contents, but a mere trace.

Symptoms.—Lead poisoning shows itself in four sets of symptoms: colic, affection of the joints (arthropathy), paralysis, and disease of the brain (encephalopathy). *Colic* is by far the most frequent symptom. It may come on gradually or suddenly. It occurs in attacks of intense griping pain in the region of the umbilicus or anywhere about the abdomen. The pain is often attended by nausea, retching and vomiting, sometimes by excessive tenesmus. The *pulse* is *retarded* sometimes to thirty in the minute—a characteristic feature. The tongue is coated, the breath offensive. A *blue line,* from deposit of lead, is often seen *on the gums.* The *abdomen is retracted, the bowels constipated.* The attack lasts, with exacerbations and remissions, several days to a week, and terminates gradually, sometimes suddenly. The *prognosis,* aside from other symptoms of lead poisoning, is favorable.

Arthralgia manifests itself in *pains in the joints,* chiefly of the lower extremities, especially the *knee;* and cramps of the muscles, especially the flexors of the leg, which sometimes also show *tremor.* This condition of tremor may be seen also in other muscles, even facial muscles, which are never affected with any other expression of the disease.

The *paralysis,* on the other hand, affects principally the extensors, and of the upper rather than the lower extremities. Paralysis of the extensors of the hand, *wrist-drop,* with preservation of the power of pronation and supination, is characteristic of lead poisoning. The triceps and deltoid are next most frequently affected. Sensation is not disturbed, but *trophic change* is always present and is manifest by *wasting,* which is equalled only by that which occurs in progressive muscular atrophy. The paralysis may disappear rapidly, or remain for years or for life.

The brain symptoms—*encephalopathies*—are distinguished by their gravity. They occur usually late, but may supervene early in the course of lead poisoning. The most common form is *eclampsia,* which is distinguished by the fact that it is never preceded by an aura and is rarely attended with complete loss of consciousness.

The patient may pass from one attack to another in the course of several days, and any attack may prove fatal. *Amaurosis*, wholly of brain origin, with perfectly normal conditions about the eye, is not uncommon. Attacks of mania, melancholia, and various psychoses vary the scene.

The *treatment* of acute poisoning consists in washing out the stomach with the stomach tube or stomach pump, in the administration of the alkaline sulphates of sodium, potassium, and magnesium. The patient should be purged with Epsom salts. In the absence of antidotes, milk and albumen (white of egg) should be administered freely.

Prophylaxis of chronic poisoning is best observed by cleanliness. Painters should not put paint brushes in their mouths, and all workers in lead should practise ablution before eating. Working rooms should be better ventilated, etc.

The *treatment* of chronic lead poisoning consists also in the frequent use of the stomach tube. Dilute sulphuric acid should be taken with the drink. Iodide of potassium is administered internally with the view of making soluble compounds which may be eliminated by the kidneys. Sulphur baths are recommended. Semmola reports some remarkable results with the electrolytic action of the constant current. The positive pole is put on the tongue, the negative at the pit of the stomach ; later the poles are changed to the spine and abdomen, sessions daily, ten to fifteen minutes' duration, strong currents, one hundred to one hundred and thirty milliampères. Obstinate, even grave, symptoms disappear entirely in time. Removal of the cause, change of work, is, unfortunately, often a necessity.

ALCOHOLISM.

Alcohol (Arabic, *kahala*) may be disposed of as food in quantities of one pint of beer, or one-half pint of Rhine wine, or four ounces of sherry wine, or two ounces of whiskey per day. Beer contains four per cent, Rhine wine eight per cent, sherry twenty per cent, whiskey forty per cent of alcohol. Quantities above this amount constitute excess which does damage to tissue and leaves lesions.

Alcohol whips up the heart, feeds the brain, and thus forces energy in states of exhaustion, but at the final expense of the machine, which should recuperate through rest. "The worker in the use of alcohol consumes his capital instead of his interest, with the inevitable result of bankruptcy in time" (Sippe).

Drinkers have less working capacity, less endurance, and shorter life than the temperate or totally abstinent. Thus the mortality statistics of a leading insurance company of London—which made

two classes, one of the totally abstinent and the other of all others—showed for the abstinent seventy-one per cent and for the rest ninety-seven per cent, a difference of twenty-six per cent in favor of the abstinent.

Billings makes this fact very plain by the following table, showing the mortality of dealers in liquor (twenty-five to sixty years of age) from various diseases, compared with that of men generally of the same ages :

	Liquor dealers.	Men generally.
Alcoholism	55	10
Liver disease	240	39
Gout	13	3
Diseases of the nervous system	200	119
Suicide	26	3
Diseases of the urinary system	83	41
Diseases of the circulatory system	140	120
Other diseases	764	653
All causes	1521	1000

Alcoholism as a disease occurs in two forms, acute and chronic.

Acute Alcoholism shows itself with loss of consciousness, as a sudden intoxication. The face is flushed and dusky, the eyes prominent and staring, the pupils dilated, the surface is cool and insensible, the pulse retarded and irregular, the respiration stertorous. The breath smells of alcohol, as does also the vomited matter which is often found upon the clothes or in the vicinity of the patient. The temperature may fall as low as 75° F. The individual thus affected is said to be "dead-drunk." The patient may succumb to heart failure and collapse in this attack of coma, or may recover after a stage of long and heavy sleep. Coma which lasts over twelve hours is usually fatal. The victim of intoxication by alcohol is especially liable to suffer and succumb to epilepsy, pneumonia, œdema of the lungs, and failure of the heart. Under exposure in cold weather such patients easily freeze to death.

Chronic Alcoholism reveals itself in organic disease and in various neuroses, including a special form known as delirium tremens. Catarrh of the stomach, cirrhosis of the liver, chronic nephritis, fatty degeneration of the heart, atheroma of vessels, are the common manifestations of continued abuse of alcohol. The nervous system is affected in all its functions, in every direction. Disturbance of motion shows itself in *tremor*, which especially affects the extremities and tongue, and occurs as fine rhythmic oscillations. Muscular *force* is everywhere reduced. The tone of the face is lost, the

patient staggers in his gait, the grasp of the hand is enfeebled. More pronounced are the disturbances of *sensation*, which occur as paræsthesiæ, hyperæsthesiæ, and neuralgias, an especial form of which is set apart as the alcoholic neuritis. Disturbances of *special sense* are manifold. Flashes of light, derangements of vision, ringing in the ears, etc., are common signs. Alcoholism shows nearly every form of *psychosis*. The memory is impaired, comprehension enfeebled, the power of concentration lost. Victims of alcohol are full of bravado, often of brutality, but fail in real courage. Alcohol begets suspicion. A common delusion is a suspicion of marital infidelity, an act of which the patient may claim to see before his eyes. Outbreaks of mania are not infrequent, and are often distinguished with difficulty from the initial stage of paralytic dementia; or mania alternates with melancholia. The psychoses take sometimes the form of paranoia with sleeplessness and delusions. The patient is persecuted with visions. Distinctive features of the delusive vision are the number, movement, and minuteness of surrounding objects.

Treatment.—In acute intoxication the excess of alcohol may be allowed to eliminate itself in sleep. In recent ingestion the stomach may be washed out with the tube and mouth gag or the stomach pump. Stimulation of the respiratory centre by cold affusion is the most effective restorative. The extremities should be kept warm. The alcohol habit may be arrested and aversion for liquor excited for a time by the subcutaneous injection of strychnia nitrate gr. $\frac{1}{20}$, and atropia sulphate gr. $\frac{1}{100}$, twice daily for two or three weeks. Isolation in an institution for the purpose is often a necessity. Permanent cure may be effected only by strengthening the will, wherein "the patient must minister unto himself."

DELIRIUM TREMENS—MANIA A POTU.

A special form of alcoholic intoxication distinguishes itself by the prominence of two symptoms, *delirium* and *tremor*, and has hence received the appropriate name, delirium tremens. The disease is usually prefaced for several days by excessive nervousness and sleeplessness, and *insomnia* is a third cardinal symptom of this disease. The victims of alcoholism are haggard and worn from loss of sleep. Delirium tremens occurs only in certain individuals, not in all cases of alcoholism. Victims of this affection come of neuropathic stock, or suffer themselves some other form of neurosis. According to Westphal thirty per cent of cases are victims of epilepsy before the first manifestation of delirium tremens, and thirty per cent of the remainder are seized with epilepsy during attacks. This fact has more to do with the development of delirium tremens than the quantity of alcohol alone. Delirium tremens is an expression also of *ex-*

haustion of nerve centres. So long as food is retained and digested delirium tremens does not occur. The condition develops only in the presence or as the result of a subacute or chronic gastric catarrh, which may be itself in turn the effect or expression of the abuse of alcohol. A trauma, a surgical operation, a severe intercurrent disease, pneumonia, may precipitate an attack.

The delirium is peculiar, and is distinguished especially by *expressions of fear.* Most patients do not "see snakes," as is commonly believed. Patients surrounded by animals are plagued by their number rather than their size. Bugs, flies, fleas, beetles, in millions and myriads, crawl about their beds, crowd the air of their rooms, fill the whole space. More frequently patients make of objects in their vicinity fantastic creatures, or look upon attendants as thieves and assassins, from whom they start and shrink with fear. Chronic *psychoses* may develop from these states. Mendel says that Lasègue reported the case of a patient who maintained that his family had cut off his penis and substituted for it an organ of lead, which was not properly fastened and greatly incommoded him in getting about. Such patients often report with circumstantial evidence crimes which they have committed or seen committed, but which have no foundation in fact. Suicide or attempted suicide occurs in six per cent of cases of delirium tremens.

The *tremor* shows itself especially in the hands, arms, tongue, and lips. The double or disturbed vision, which leads to so many ludicrous mistakes in the drunkard, is a tremor or paresis of the muscles of the eye. The perception of *sensation* is even more completely annulled. The subject of delirium tremens loses all sense of pain. He lies out over-night until his extremities are frozen, and the victim who has fallen in his flight from imaginary danger will lift himself up on broken legs or hobble about on a cracked pelvis, oblivious of pain.

The degree of *insomnia* is evidenced by the quantity of opium or other anodyne necessary to secure sleep. Thomas Sutton, who named the disease, gave one of his patients forty-two grammes of opium in all without securing the desired effect. The stage of delirium lasts two to ten days, and terminates with a long, heavy sleep.

The *diagnosis* rests upon the peculiar delirium, tremor, and insomnia. The disease is distinguished from the delirium of typhoid fever, septicæmia, etc., by the absence of fever in pure delirium tremens.

The *prognosis* is grave, though most patients recover from the individual attack. The immediate outlook is determined more by the condition of the stomach than by any individual factor. Patients able to ingest and digest food speedily recover. The condition of the heart establishes the final prognosis.

The *treatment* consists in restoring tone to the nervous system with food. Attempt to force sleep with powerful anodynes is not good practice. The best results are accomplished with the use, as soon as possible, of the stomach tube and the administration of dilute hydrochloric acid. Frenzied patients should be subjected only to that degree of restraint necessary to prevent injury. The bromides are prescribed as sedatives in routine treatment, but always with the risk of damage to the stomach. Chloral is the most powerful hypnotic, and may be given with safety at night in doses of ten or fifteen grains to young, strong, and healthy subjects, but should not be administered in the presence of a feeble, fatty heart. In these cases the best remedy is digitalis, which may be given in the form of infusion, teaspoonful to a dessertspoonful every two to four hours, or the tincture gtt. x. at the same interval. Digitalis also does damage to the stomach. Opium is the last resort. It is better, when possible, to bear with the malady for a time than to destroy or injure the process of digestion. The real cure of delirium tremens rests with the patient rather than the physician. The broken will must be built up by the individual himself.

The craving for alcohol, *dipsomania*, is a desire which asserts itself periodically and leads to excessive indulgence for a period of a week or two, or until a gastric catarrh thus induced or a delirium tremens puts a stop to further drinking. Dipsomania is itself a neurosis dependent upon unstable nerve cells. The nervous symptoms, insomnia, dread, tremor, which ensue in the course of such indulgence, though they are most severe at the close of a debauch, are caused by the alcohol itself and not by abstinence. Hence they are best controlled by immediate and absolute abandonment of the use of alcohol—a sacrifice which can only be successfully made in an institution under supervision and restraint. The collapse which may follow such heroic treatment is obviated to some extent by the use of atropia gr. i.–$\frac{1}{3}$ i., gtt. iij.–v. every three or four hours, or hyoscyamine in the same dose. The heart and the nervous system are best sustained subsequently by strychnia gr. $\frac{1}{20}$ ter die or by the tincture of nux vomica gtt. x.–xx. ter die. The aromatic tincture of rhubarb, ʒ i. ter die, diluted, is a good stomachic tonic in these cases.

COCAINISM—POISONING BY COCAINE.

Cocaine poisoning may be acute or chronic. Acute poisoning occurs in consequence of excessive use, in operations about the eye and throat, and after subcutaneous injections to secure anæsthesia for more extensive procedure (circumcision, etc.) ; sometimes after injection of stronger solutions into the bladder, nasal cavity, etc. Reclus collected fifteen deaths, mostly from overdosage, ten to fifteen

grains. One to one and a half grains (one-half to one grain by injection) is maximum dosage. For anæsthesia, cocaine, perfectly pure, should be injected *into* and not under the skin or mucous membrane. The object is to reach the nerve endings in the skin. The injection should be made slowly, drop by drop. Acute cocainism is marked by *collapse*, with *pallor of the face, vertigo, nausea, precordial anxiety, cyanosis, and syncope.* Poisoning in less degree is attended with *delirium* marked by *hilarity, volubility,* sometimes by *hallucinations and mania.* Convulsions may occur in the course of the intoxication. Anomalous cases are marked by *cardialgia, palpitation, insomnia, amblyopia.*

Chronic Cocainism produces *cachexia with nervous debility,* neurasthenia marked by anorexia, marasmus, insomnia. Patients complain of *dryness of the throat, palpitation of the heart,* and suffer attacks of *dyspnœa and difficulty of articulation.* Chronic cocainism develops a *peculiar paranoia,* marked by hallucinations of sight and hearing, ideas of persecution, and attacks of melancholia.

Tests.—Cocaine may be recovered from the urine. The addition of potassium permanganate produces a violet-red precipitate, which soon becomes brown. A solution of cocaine brought into contact with white filtering paper saturated in a solution of the ferrocyanide of potash and chloride of iron develops a blue spot in two minutes.

Treatment.—Acute poisoning is treated by cold douches, with artificial respiration and massage. Convulsions are controlled by chloroform or amyl nitrite. Injections of ether or caffeine sustain the heart until the patient can swallow, when he may be fed with black coffee. Morphia, gr. ¼ subcutaneously, is also antagonistic to cocaine.

Victims of chronic cocainism must be treated as in opiophagism. Real results are to be obtained as a rule only in an asylum, where the weak will of the patient is substituted by the strong will of authority.

POISONING BY OPIUM.

Poisoning by opium (ὀπός, juice) is acute and chronic. The susceptibility to opium differs, and the dose which may be injurious or fatal varies according to age and still more according to habit. Children are particularly sensitive. A single drop of laudanum has produced dangerous narcosis, and two drops have proven fatal through coma and convulsions. Three-fourths of all the deaths from opium occur in childhood under the age of five years. On the other hand, opium eaters may secure such tolerance as to be able to dispose of a drachm of morphia in a day. In these cases the mass of the morphia is unabsorbed. Most cases of opium poisoning in adult life occur among opiophagists who recommence the use of the drug, after cessation or reduction, with too large a dose.

Acute poisoning shows itself in sensations of warmth, *stimulation* of the intellectual faculties ; later, sense of oppression, drowsiness, uncontrollable desire to *sleep*, and heavy slumber. Sometimes there is, instead of sleep, intoxication with headache, vertigo, tremor of the hands, twitchings, and convulsions. Itching of the nose and of the face, and of the whole body (*pruritus opii*), is a common and characteristic effect of opium. Erythema may develop. The patient recovers with a sense of languor, headache, anorexia, nausea, and constipation. In opium narcosis the *pupils are contracted*, often to the size of a pin's head, and are irresponsive ; the eyes are fixed, the pulse is irregular, the patient is unable to swallow, respiration is paralyzed, and death occurs with stertor and coma.

Chronic poisoning is frequent. The subjects of chronic poisoning are the victims of the opium habit, which is, in places, as in the East, a national vice. Chronic poisoning shows itself as a cachexia with degradation of the intellectual and moral faculties, with impotence in men and sterility in women. The continued use of opium begets a condition of unrest, ill-defined anxiety, insomnia, with gradual alienation, stupefaction, of the individual ; tremor develops, with pallor, paræsthesia, sometimes with albuminuria. Anorexia is pronounced. Chills occur, with sweats. Constipation remains obstinate, or is substituted in certain cases by diarrhœa and vomiting. Conditions of collapse sometimes supervene. Many of these symptoms are intensified on withdrawal of the drug, and then constitute what are known as "abstinence signs." There is in this state unappeasable craving for morphia, which may eventuate in maniacal attacks. In the experience of the author a patient at the hospital wore out two attendants, who finally fell asleep. The patient, a young lady, arose from bed, made a rope of the bedclothes, let herself down from a second-story window to the ground one cold December night, and was found by a policeman standing at the door and trying to effect an entrance into a drug store. No less than nineteen hypodermatic syringes were removed from pockets, lining, seams of the suit of clothes worn by another patient, a man, a confirmed victim of morphinism.

Treatment.—The question is, shall the drug be withdrawn suddenly or gradually? And the answer may be determined by the effects which supervene upon sudden withdrawal. Where the patient is able to endure the suffering and survive the prostration, absolute withdrawal is best. The amount of suffering is less in the long run. Otherwise the drug may be withdrawn gradually. The patient must be isolated and guarded. No victim of morphinism may be treated successfully at home or at any ordinary hospital. The patient must be put where he absolutely cannot obtain opium.

The attempt to substitute morphia by other anodynes or hypnotics gives no real or permanent relief. Temporary relief may be secured by cannabis indica, hyoscyamus, atropia, cocaine, the bromides, etc. Strychnia nitrate, especially when injected subcutaneously, gr. $\frac{1}{40}$–$\frac{1}{24}$, in combination with sulphate of atropia gr. $\frac{1}{120}$, best supports the nervous system. Caffeine, strong coffee, support the heart. Irrigation of the stomach, warm baths and trional, with time, good feeding, and, as far as it may be secured, good cheer, carry the patient through.

POISONING BY NICOTINE.

Nicotine, an active principle of tobacco, is one of the most dangerous of all the alkaloids, ranking next in virulence to hydrocyanic acid. The quantity of nicotine varies in different kinds of tobacco. Common tobacco contains seven to eight per cent, finer Havana less than two per cent. Animals vary also in resistance to nicotine, in descending scale, according to Berutti and Vella: centipedes, flies, butterflies, spiders, fish, frogs, dogs, rabbits, and cats. A dog is killed by one and a half to two drops, a rabbit by one-fourth of a drop, small birds by a touch on the beak with a rod dipped in nicotine. Dangerous symptoms of intoxication have been observed in man at the dose of 0.003 gramme. Tobacco contains also other substances—volatile oils, pyridin, prussic acid, carbonic oxide, marsh gas, etc.—in varying quantities, usually too minute to produce much effect. Stronger tobacco can be smoked from a cigar than from a pipe, as the volatile and benumbing pyridin is totally consumed in the cigar, and only imperfectly consumed in the bowl of a pipe.

Symptoms.—Mammals poisoned with nicotine show unrest and excitement, tremor, discharges from the bowels and bladder, stupor, clonic and tonic convulsions. These symptoms have been observed after smoking, after the use of the infusion of tobacco in therapy, in poultices and clysters.

Small doses of nicotine excite the vagus and thus reduce the frequency of the heart. The blood pressure falls, with paralysis of the peripheric vessels. The temperature is reduced. In small quantities, nicotine, by its effect on the nerve centres, allays nervousness, quiets discontent, subdues ambition, reconciles to idleness. The percentage of college students who use tobacco is, as a rule, less than that of those who abstain. In sensitive subjects, or in excess, tobacco produces anorexia, nausea, catarrh of the stomach, catarrh of the throat, palpitation, neuralgia of the heart, angina (pseudo) pectoris, delirium cordis, tremor, nervous excitement, hypochondriasis, amblyopia—conditions which all disappear, to leave no lesion, on cessation of use.

POISONING BY GASES.

Gases, as they affect the animal body, are divided into the indifferent, irrespirable, and poisonous.

The indifferent are the gases which have in themselves no injurious effect, but may become injurious by accumulation, simply because they diminish or dispel the natural air. To this category belong nitrogen, hydrogen, and carburetted hydrogen (marsh gas). Nitrogen may occur in mines to diminish the proportion of oxygen (which should be twenty-one) to fifteen per cent. Such a diminution may lead to emphysema ; still greater reductions may produce asphyxia.

The irrespirable are the gases which, in slight quantities, produce certain injurious but not dangerous effects. Among these may be cited sulphurous acid, nitric acid, muriatic acid vapors, and the vapors of ammonia, chlorine, bromine, and iodine. These gases are present or accumulate in certain trades. *Sulphurous-acid* gases are developed in the bleaching of straw, manufacture of hats and bonnets, the bleaching of silk, woollen, and cotton goods, the manufacture of brushes, and in coal, sulphur, and silver works, as well as in the manufacture of sulphur acids themselves. They occur also in the distillation of coal. The accumulation may be but slight, one, two, or three per cent, according to the degree of ventilation; or it may increase, as in the manufacture of sulphur acids, to seven per cent. Sulphurous-acid gases are absorbed into the blood and act directly upon the nerve centres. The vaso-motor centre is at first excited; later paralyzed ; the respiratory centre is affected in the same way. The inhalation of the sulphur acids in slight quantities produces irritation of the throat, cough, angina, and bronchitis. The strong concentrations induce spasm of the glottis and, with a reduction of oxygen, asphyxia.

The *nitrates* occur in the fabrication of nitric acid, nitro-benzine, and in certain copper, soda, and gold works. The vapors are usually present in but very small quantity; local effects are, however, distinct. There is irritation and burning in the nose, constriction with a sense of suffocation in the throat, cough, dyspnœa, and general symptoms of distress on the part of the digestive system and respiratory organs. *Muriatic-acid* vapors occur in the fabrication of soda, the vulcanization of caoutchouc, in the glazing of pottery, manufacture of glass, production of artificial manure, always only in minute quantities. *Hydrofluoric-acid* vapors, which are developed in the engraving of glass, crystal, etc., produce irritation of the eyelids and eyes, intense coryza, and spastic bronchitis. *Ammonia* vapors are inhaled in the manufacture of ammonia, in the preparation of mercury, in tanning, sewer cleaning, tobacco, sugar,

and artificial-ice factories. In certain concentration ammonia produces constriction of the chest, which may increase to suffocation, increase of the blood pressure, with ischuria. In such saturation the odor of ammonia, excreted by the sweat, emanates from the body. *Chlorine* is developed in the manufacture of chlorine, nitric acid, chloride of lime and the alkalies, artificial soda, and in the various bleaching trades. The first effect of inhalation of chlorine is irritation of the mucous membrane of the respiratory organs. The second, reflex actions, especially spasm of the glottis. Epiphora, sneezing, cough, pains in the chest, dyspnœa, occur at once in acute cases. Chronic cases are characterized by blood spitting, spasm of the glottis, and pneumonia of rapid course. Workers with chlorine undergo emaciation, show a bad color, and suffer from catarrh of the stomach and chronic bronchitis. *Bromine* and *iodine* exercise similar effects.

The poisonous gases are especially *carbonic oxide* (monoxide), *carbonic acid* (dioxide), and *sulphuretted hydrogen.* Ordinary illuminating gas contains a large number of poisonous gases, along with carbonic acid and oxide, among which may be cited ammonia, cyanogen, bisulphide of carbon, and sulphuretted hydrogen. *Carbonic oxide* is a colorless, odorless, and tasteless gas, which burns with a blue flame. It is exquisitely poisonous to the animal organism. Absorbed into the blood it displaces oxygen from the hæmoglobin, and forms new combinations with the coloring matter of the blood, whereby the corpuscles are rendered incapable of further absorbing oxygen. This combination imparts the peculiar cherry-red color to arterial as well as venous blood. The gas does not separate from its combination in vacuo, but may be displaced by other gases or by the air pump.

Carbonic oxide is developed also in iron smelting and in the manufacture of coke, in which process coal is subjected in ovens to dry distillation. Carbonic-oxide gas occurs also in the usual heating of houses, and may thus induce poisoning. The imperfect combustion of coal develops carbonic oxide. This imperfect combustion occurs especially in arrangements for heating which do not admit of sufficient ventilation. Biefel and Poleck give the following as the average composition of numerous analyses of coal smoke: carbonic acid, 6.75 per cent; carbonic oxide, 1.34 per cent; oxygen, 13.19 per cent; nitrogen, 79.72 per cent.

Carbonic oxide does not usually accumulate in the air of a room, because it escapes with the products of combustion; but it accumulates in the room when the escape of gases through the chimney is hindered by the closure of the draught valves in the stove or furnace, or when the chimney is stopped by soot. Any hindrance to the entrance of air leads to the accumulation of carbonic oxide. The

quantity of carbonic oxide necessary to make the air injurious is variously given by different authors. Fodor maintains that a proportion of 0.5 per thousand continuously inhaled is decidedly deleterious. Biefel and Poleck found a percentage of 0.19 fatal to rabbits.

In poisoning by carbonic oxide there is dulness and drowsiness; *the face is at first flushed, later pallid, and still later livid and cyanotic.* The stupor of the nervous system may be so great as to reduce to the minimum the difficulty of breathing. Sometimes there is *dyspnœa* with the convulsions of asphyxia. Suffocation may set in under stupor without much dyspnœa, and convulsions may occur only at the close. The pulse is at first full and rapid; later, in the state of coma, scarcely perceptible. The *temperature sinks* two or three degrees. The urine may contain sugar and albumin. There is at times local, and at times general, anæsthesia of the surface. Paralysis of the bladder and intestine may occur.

Carbonic-acid poisoning occurs not infrequently in certain trades. The exhalation of carbonic acid from the body is in proportion to the quantity of gas in the air. When this proportion reaches a certain amount, the gas is not given off, but accumulates in the organism, produces dyspnœa, and finally paralysis of the sense of respiration. Carbonic-acid gas is thus a narcotic, and belongs to those poisonous gases to which the body becomes gradually accustomed. Carbonic-acid-gas poisoning in open air occurs in places where the gas issues from the earth in large amount, as in the Grotto of Puzzuoli, where it is, from its weight, fatal to dogs; at Pyrmont, in the poisonous valleys of Java, and certain places in the neighborhood of volcanoes; also in mines, as well as wine and beer cellars, and apartments crowded with people, etc.

The *treatment* of poisoning by gases is the admission of fresh air, the use of artificial respiration, the administration of oxygen, and, in the case of the poisonous gases, the practice of transfusion.

The operation of transfusion of blood itself is now done directly from vein to vein with the apparatus of Aveling, a procedure which requires some skill; or by the use of three different syringes, that one may be kept always cleaned, *i.e.*, sterilized and warmed, ready for use, according to the method of Ziemssen, a perfectly safe procedure in clean, *i.e.*, aseptic, hands. Landois made use of the fact that blood does not clot in the body of leeches in preparing a decoction of leech heads with 0.6 per cent of common salt, and Wright made use of the fact that blood does not clot in the presence of certain salts to receive it as it flows in a solution of sodium oxalate to keep it thin. By these methods the troublesome operation of defibrination is avoided. In no case may heterogeneous blood—*i.e.*, blood from a different animal—be used in the body of man.

NOTES.

Sycosis (p. 14). For every-day use :

℞ Acidi tannici 2.0
Sulphur præcipitatis 4.0
Zinci oxidi,
Amyli ..... āā 7.0
Vaselini 20.0
M. S. Apply daily.

To destroy the parasite :

℞ Sublimati 1.0
Spiritus vini gallici 99.0
M. S. Dab the surface with cotton morning and evening, after epilation.

Bacteria, selective action of (p. 64) ; used as destructive agents. Löffler exterminated the field mice, which multiplied to constitute a plague in Thessaly, by feeding them with the Bacillus typhi murium, a micro-organism innocent to all other animals.

Hydrophobia, treatment of (p. 103). Blasi and Travati find that lemon juice most quickly neutralizes the poison of hydrophobia. Thus lemon juice destroys it within three minutes, creolin in one-per-cent solution in three minutes, etc. Carbolic acid is one of the feeblest agents, as a five-per-cent solution requires fifty minutes, a three-per-cent solution one hour.

Influenza. Salipyrin (p. 122) is not a real specific, and there is no specific. Salipyrin acts only as an antineuralgic and antifebrile—*i.e.*, as a symptomatic remedy (Fürbringer). Children are very rarely affected, and always later than adults (Baginsky).

Tuberculosis (p. 147). The hectic fever is not caused by the tubercle bacillus, but by the streptococcus. Koch calls the see-saw hectic temperature record the "streptococcus curve."

Agaricin in night sweats of tuberculosis (p. 156). Agaricin acts slowly, not before five hours, but as long as for twenty-four hours. It should be given, therefore, early, at 5 P.M., in a pill or in syrup.

Syphilis (p. 174). Pigmented syphilides.

℞ Corrosive sublimate,
Salol ..... āā 1 part.
Alcohol ..... 100 parts.
Bergamot (or geranium) oil ..... enough to perfume.

Rub the spots with this solution daily, and let them dry without wiping. When they have become a little attenuated bathe them lightly with the following lotion :

℞ Glycerin,
Rose water ..... āā 25 parts.
Borax ..... 2 "
Corrosive sublimate solution 1 : 1000 ..... 10 "

Later on apply the following dusting powder :

℞ Talc, powdered,
Zinc oxide,
Camphor, powdered,
Salol ..... āā equal parts.

Itching.—A fine preparation for relief of itching after measles, scarlet fever (p. 216), etc., is that of Klein:

℞ Lanolini purissimi (Liebreich) anhydrici 50.0
Vaselini puri 20.0
Aquæ destillatæ 25.0
Misce terendo; fiat unguentum. S. Apply every three hours.

The evaporation of the water cools the surface and thus lessens the hyperæmia of the cutis.

Ear Furunculosis after scarlet fever, etc. (p. 217). Cholewa finds by far the best remedy is menthol, a ten-per-cent solution in oil. Apply with cotton, which is inserted and allowed to remain. The pain is relieved on the day of application, as the vapor of menthol kills the micro-organisms. Continue the treatment for eight days to prevent recurrence.

Diphtheria. A streptococcus (p. 247), whose virulence was tested in every way, was found by Landmann in the well-water which supplied five families in the suburbs of Frankfort. Three of five cases in these families died of diphtheria which developed from a streptococcus angina evidently introduced by the drinking-water.

Diphtheria, Blood Serum Therapy (p. 252). Behring claims to secure both immunity and cure of pure diphtheria by inoculation with the blood serum of animals—dogs and sheep—rendered immune to diphtheria. The animals are rendered immune by injection of diphtheritic matter of gradually increasing virulence. The serum is

prepared and preserved with 0.6 per cent carbolic acid ready for use. It is perfectly innocuous in the dose of 1 gramme per day for every kilogramme of body weight. Experiments upon animals yield perfect results. Diphtheria in man is, however, not a pure process. It is usually complicated with sepsis—*i.e.*, streptococcus infection, upon which the blood serum has no effect. Nevertheless in all the cases thus far reported the mortality has been reduced from sixty to twenty per cent.

Typhoid Fever, perforation of intestine (p. 284). Of 12 cases thus far operated upon but 1 recovered (Freyhaus).

Gastro-intestinal Catarrh of Infants (p. 364). Of 1,000 cases of death from summer diarrhœa Hope found but 30 that had been fed exclusively at the breast, and Meinert found but 24 of 602. Meinert and Seibert showed that diarrhœa begins at 60° F., and becomes epidemic when the mean daily temperature does not fall below this degree.

Alimentation per Rectum (p. 395). Maragliano reported a case where a patient was fed *exclusively by the rectum for ninety-four* days and ultimately recovered. At the end of that time she was found to have lost only 2.7 kilogrammes (6 pounds avoirdupois) in weight. The nutrient enemata employed in this case were prepared as follows: 300 grammes (10 ounces) of beef and 150 grammes (5 ounces) of pancreas were pounded together in a mortar and the juice strained. To this were added 5 grammes (75 grains) of sodium carbonate, 25 grammes (6 fluidrachms) of fresh ox bile, and water a sufficiency. The enema was administered in four portions in the course of the day, with a sufficient quantity of warm water. This formula differs from that recommended by Leube only in the addition of ox bile—a modification introduced by Sciolla for the purpose of stimulating absorption of the enema by the large intestine and of preventing putrefactive decomposition.

Stomach Tube. In the introduction of the stomach tube (p. 369) always push it in the throat to the left to follow the entrance of the œsophagus.

Stomach. Hyperacidity of the gastric juice (p. 375) is shown whenever it requires more than 0.65 liquor potassæ to neutralize 10 cubic centimetres of gastric juice.

Occlusion of Intestine (p. 433). Spontaneous cure, according to the latest reports, is more frequent than is commonly believed. Thus Goldtdammer saw 15 recoveries in 50 cases treated wholly on the expectant plan.

Biliousness (p. 475). The liver protects the body against auto-intoxication. This antitoxic is one of the chief functions of the liver. Poisons are introduced into the intestine with the foods (alkaloids, potash salts, alcohol, etc)., or as products of the action of micro-organisms, ptomaines, toxines, toxalbumins. Material is brought also by the blood for the formation of bile, urea, etc. The liver in health disinfects and purifies all these matters. Slight interference with this action of the liver produces the discomfort and distress of "biliousness"; abolition of action produces the ominous signs of icterus gravis.

Pleurisy (p. 543). Serum free of bacteria is usually the result of tuberculosis. The effused serum may contain so few bacilli that a syringeful may fail to inoculate a healthy guinea-pig, but may produce in a tuberculous guinea-pig the characteristic reaction of tuberculin.

Myxœdema (p. 589). Different views have recently tended to unite in the belief that the three processes—strumous cachexia, myxœdema, and cretinism—have the same original cause. All cases seem to be due to the absence of the thyroid gland. In the examinations of 13 cretins at the Salkammergut, 10 were found in whom more or less large tubercles of the thyroid were seen, and 3 in whom no trace of a thyroid gland was found in the neck.

Arterio-capillary Sclerosis (p. 590). Alanus advances the view that this condition is due to a too exclusive vegetable diet. He observed it in himself—a young man, not yet forty years of age, and not addicted to alcohol—in the temporal and radial arteries. Raymond saw it in a number of young monks, vegetarians, and Treille remarked it of the inhabitants of Bombay and Calcutta, who live largely on rice. According to Gabler the mineral salts in the vegetables come to be deposited in the walls of the blood vessels. "Vegetable food injures the blood vessels and precipitates the changes of age."

Larynx Tuberculosis (p. 489). Siemen strongly recommends the inhalation of iodoform according to a formula which masks the evils (odor) but preserves the curative effects. Thus:

℞ Iodoformi..... gr. xv.
Olei eucalypti ..... ʒ vi.
Olei caryophilli ..... ʒ i., gtt. xv.
Alcohol absoluti..... gtt. ij.

M. Pour ten to fifteen drops upon oil of turpentine and inhale three or four times a day.

Gonorrhœa (p. 179). The view that gonorrhœa is only a local

process is much modified by the actual discovery by Leyden of the gonococcus upon the valves as the cause of a verrucose endocarditis.

Abbott recommends for the purpose of obtaining a good double staining of gonococci the following method: A drop of suspected pus is smeared upon the surface of a cover glass, and after drying is treated with a strong (twenty-per-cent) solution of tannic acid. It is then washed in alcohol, and after drying stained with Ziehl's solution of fuchsin. It is next decolorized in acid alcohol (acetic acid 1, alcohol 100; or hydrochloric acid 1, alcohol 500), and after drying restained with methylene green, washed in water, dried, and mounted in balsam. The protoplasm of the cells appears of a light-green color, the nuclei purple, and the diplococci a dark red.

Bubo. Wielander's abortive treatment: Inject into the bubo fifteen drops of a one-per-cent solution of the benzoate of mercury in two places. As many as seventy-three per cent of cases undergo resolution under this treatment, including indolent buboes six months old, previously treated in vain by incision and every other way. In some cases suppuration ceased even after it had begun.

Chlorosis, anæmia, etc. (p. 603). Iron in the form of hæmoglobin is ingested with the common, so-called blood sausage.

Pernicious Anæmia (p. 604). The view gains ground that many cases are due to helminthiasis—especially to the fish tapeworm. Wiltschur reports the actual finding of tapeworms in 5 of 30 cases.

Hydrops (p. 653). Puncture in relief of, should be done only in the legs, never in the scrotum, with the aseptic precautions mentioned. The leg should then be enveloped in thick layers of absorbent cotton. A piece of three-per-cent carbolized, or one-half-per-cent sublimated, *i.e.*, sterilized, gauze should be applied over each puncture.

Hæmaturia (p. 666). To determine if blood comes from the kidney or bladder, Ultzmann washes out the bladder and injects into it a solution of potassium iodide (1.5 per cent). The saliva is now tested for iodine, which, if found, indicates a break in the bladder, as the sound bladder does not absorb it.

Cystitis (p. 672). Marsh highly recommends oxalic acid as a sedative, which, he says, relieves the worst symptoms at once:

℞ Acidi oxalici	0.95
Syrupi aurantii corticis	80.0
Aquæ destillatæ	120.0

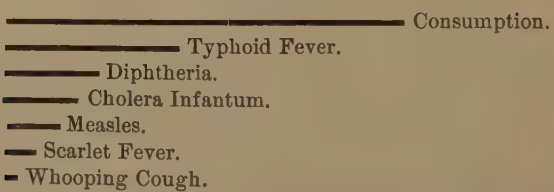
M. S. Coffeespoonful every four hours.

The Cancer Parasite (p. 67). "The cancer parasite must stand very near to the sporozoa. It certainly does not belong to the coccidia, nor to the sarco-, micro- or myxo-sporidia. Most likely it will be found among that variety of the sporozoa which Aimé Schneider long ago distinguished as the amœba-sporidia" (Ludwig Pfeiffer, *Centralblatt für Bakteriologie*, etc., August 1st, 1893).

Creosote in Tuberculosis (p. 154). The virtue of creosote depends chiefly upon the fact that it inhibits the growth of the micro-organisms of secondary infection without injuring the stomach. Thus, while a saturated aqueous solution, it does not destroy the tubercle bacillus in cultures in twelve hours (Sternberg); and while rabbits inoculated with tuberculosis and treated with creosote subcutaneously presented the same lesions as control animals not so treated (Trudeau); further, that in the proportion of 1:100 it fails, after twenty hours' exposure, to destroy tubercle bacilli in the sputum (Cornet), nevertheless it is fatal to ordinary micro-organisms in the proportion of 1:500 or 1:1000 (Wernicke, Buchholtz), without in the least interfering with the digestive action of the gastric juice. For, according to Brunton, while 1 part of chlorine in 8,540 parts of a saturated solution will arrest the digestive action of ptyalin upon starch paste, and corrosive sublimate is so enormously destructive as to arrest its action even in 1 part to 51,000, creosote has no action on ptyalin, even in saturated solution, and has but a very feeble action upon pepsin. Creosote should therefore be given internally, after meals, and not subcutaneously.

Pertussis Death Rate (p. 114). The following diagram, accurately drawn to a scale by the *American Practitioner*, shows the relative number of the deaths mentioned in the State of Kentucky for the first year of this decade:

DEATHS IN KENTUCKY, 1891.



This record may be taken as a fair average, in the absence of any prevailing epidemic, for other States and other years.

Neuralgia of the Trigeminus (p. 686). Seguin strongly recommends aconitin in pill, each containing 0.0003 gramme, two daily

for women, three for men. The number may be increased to twelve daily, or up to tolerance as evidenced by a feeling of coldness and numbness in the whole body. Cumulative effects do not occur. From a rich experience the author declares that but very few cases are not benefited and many are cured—that is, secure exemption for one to three years. In a dose of two pills per day aconitin reduces the pulse rate and arterial tension in Basedow's disease.

Migraine (p. 687). After failure with every other means Weiss found that pressure upon the abdominal aorta at a point where pulsation may be felt, midway between the xiphoid cartilage and the umbilicus, immediately arrested the most violent headache and hyperæsthesia in 23 cases. Unfortunately the distress returns after relief of the pressure, but all patients are grateful for the temporary relief.

Solutol—cresol made soluble in water by the addition of an alkali—has the highest commendation as a disinfectant (p. 79). One-fourth of a pint added to ten or fifteen pints of water (a watering-canful) makes the most penetrating, strongest, and quickest-acting disinfectant for walls, floors, etc., which may be sprinkled from the can.

Nocturnal Incontinence of Urine (p. 673). Gowers recommends as the best remedy the perchloride of iron in large doses, gtt. xx.–xxx. three times a day.

Singultus, nervous or hysterical (p. 762). Stella controls it with pilocarpine 0.10 in 10.0 water, of which ten drops three or four times a day. It is not to be used in the acute hiccough which is such an ominous sign in many grave infections.

Sulphonal in habitual use may produce a cherry-colored urine (hæmato-porphyrin) as a warning sign of saturation.

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